

# Chemical Engineering

A McGRAW-HILL PUBLICATION

APRIL 6, 1959

Published every other Monday

Seventy-five cents

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2

4

How to Make Your Own Cost Charts  
Process Details on "Chemical" Peroxide  
Different Way to Find Transfer Units  
Cost of Insulated Pipe and Equipment

# ...SEVEN SCOURING YEARS AT 1000° F.

## ... what happens?

Ordinary reactors "wash out" quickly when used under constant corrosive, abrasive and high temperature operating conditions. But not *Hortonclad* reactors!

For seven successive years, the first CB&I-built stainless steel and monel *Hortonclad* reactor (circled at right) was exposed to these severe conditions—then came a chance to inspect it during a shutdown.

Here's what CB&I and Derby Refining Company engineers found: Only microscopic pitting of the clad sheets, despite 84 months of scouring action from a bead-type catalyst. All welded seams were either flush or over flush—after seven years of continuous, high temperature service at 1000 degrees Fahrenheit.

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Derby put the *Hortonclad* reactor back on the job—with only slight repairs around the vapor inlet and outlet nozzles, which were not fabricated of *Hortonclad*!

Derby Refining Company, like hundreds of CB&I customers, made an investment in *Hortonclad* which has returned handsome performance dividends. *Hortonclad* is produced only by CB&I—through a patented continuous bonding process.

The *Hortonclad* bulletin will show you why industry leaders are turning to *Hortonclad* structures... wherever corrosive material is stored or processed. Write your nearest CB&I office for a copy.

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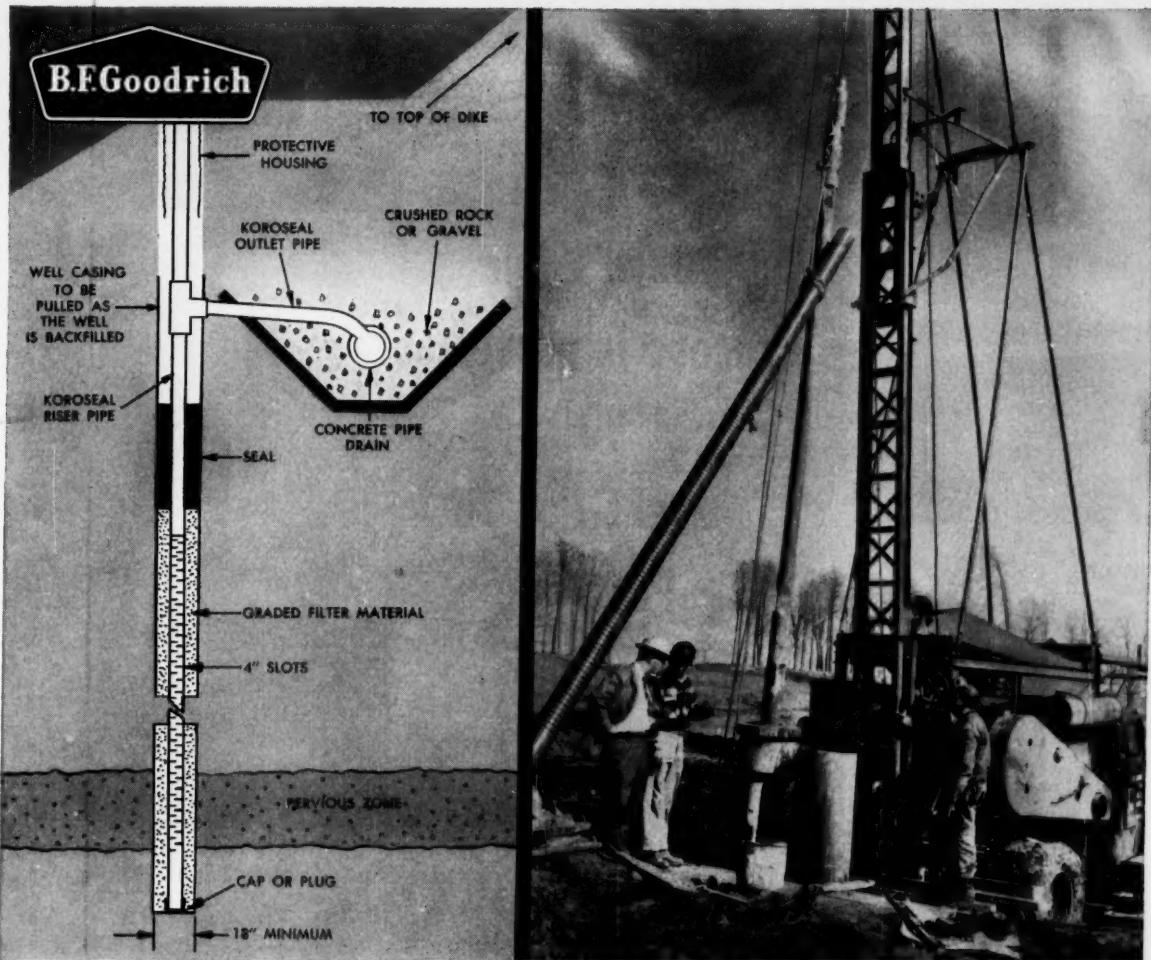
ENGINEERS



FABRICATES



ERECTS



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**Twenty-foot length** of B. F. Goodrich rigid Koroseal PVC slotted pipe swings into position for sinking as a relief well. More than 2,000 feet of this Koroseal pipe, known for its resistance to corrosion, taps "pervious zones" beneath dikes and draws off underground water that might otherwise weaken the structures.

## B.F. Goodrich Koroseal PVC pipe protects dike system on St. Lawrence Seaway

WHEN gates of the new Long Sault dam and St. Lawrence power dam were closed, a lake extending 35 miles upstream was formed. Dikes, some as high as 85 feet, were built to safeguard the surrounding countryside, including some populated areas which were 40 feet below the lake level.

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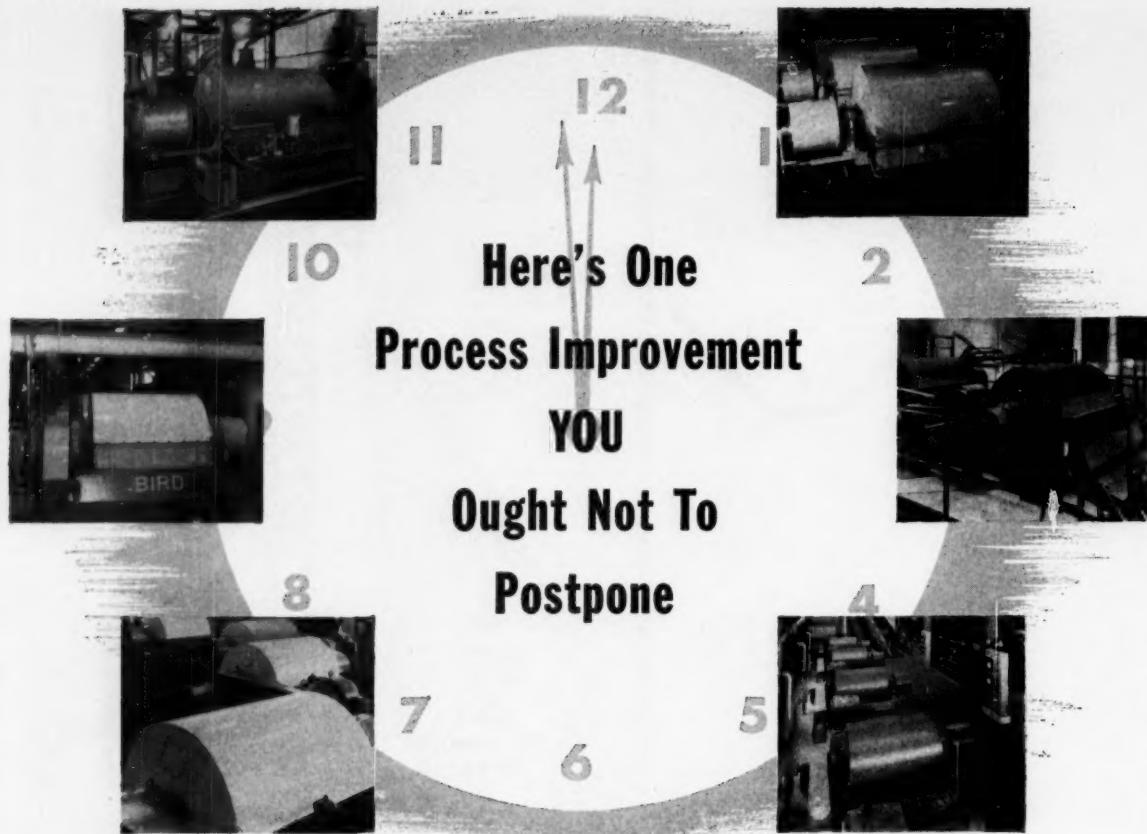
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*Koroseal pipe slotted and sold by F. C. Nichols, Inc., Norwood, Syracuse and Niagara Falls, New York.*

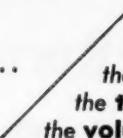
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Contents for April 6, 1959

# Chemical Engineering

Vol. 66 No. 7

CHEMICAL TECHNOLOGY FOR PROFIT-MINDED ENGINEERS

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### CHEMENTATOR

Top chemical developments and what they mean, 67  
What's new and significant in research, 72

### PROCESSES & TECHNOLOGY

Safer Storage for Liquefied Gas, 76  
Crystal Fractionation Beats Distillation, 80  
How Engineers Proved Out Sodium-Water Unit, 84

### CHEMICAL ECONOMICS

Battered Chemical Profits Will Rally in '59, *W. H. Chartener*, 90

### NEW CHEMICAL PRODUCTS

Newsworthy Chemicals and Raw Materials, 94

### NEW PROCESS EQUIPMENT

Moving-Medium Filter Heads for Chemicals, 100  
Equipment Cost Index, 186

### PROCESS FLOWSHEET

The Chemical Route to Peroxide, 118

## CHEMICAL ENGINEERING PRACTICE

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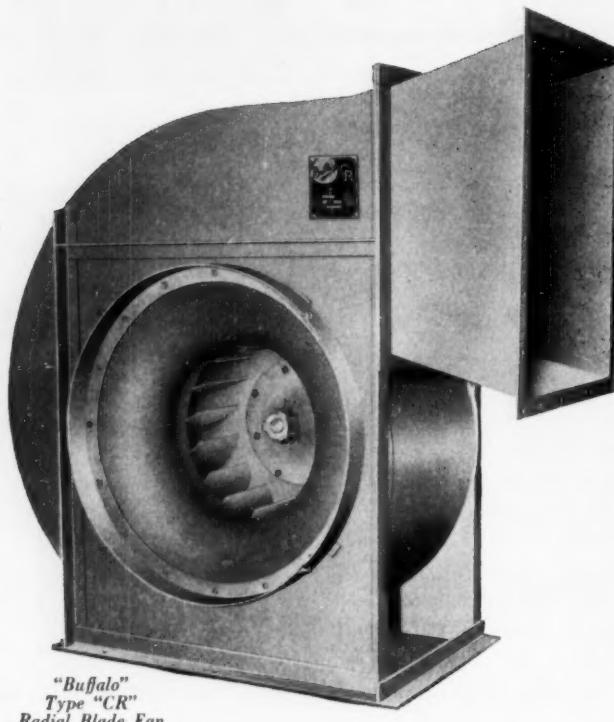
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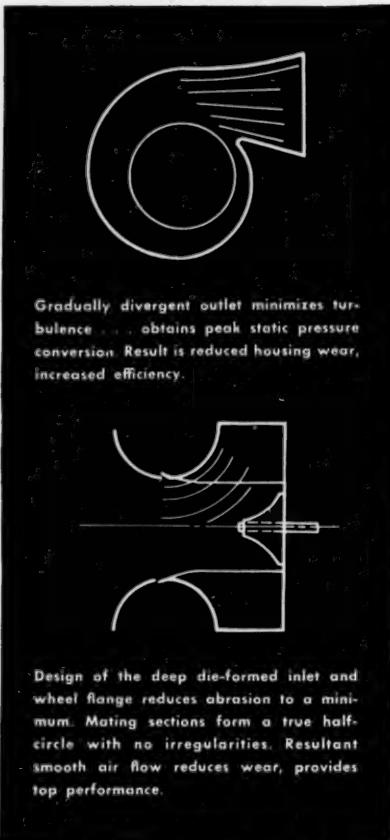
Find Mass Transfer Units, *Owen T. Hanna*, 127  
Make Your Own Cost Charts, *Harry L. Strickling* 131  
Control Valve Construction, *Werner G. Holzbock*, 135  
Physical Properties of Water, *Wallace R. Gambill*, 139  
Heat Transfer and Pressure Drop, *Ning Hsing Chen*, 141

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Contents continued . . . turn page



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Contents, continued

# Chemical Engineering

April 6, 1959

PRINT ORDER OF THIS ISSUE 49,356

<b>CE COST FILE</b>	Piping and Equipment Insulation, <i>Roy C. Kircher</i> , 146
<b>PROCESS DESIGN NOTEBOOK</b>	Plastic Sleeves Prevents Valve Shaft Seizure, <i>Zenon Todorski</i> , 148 Four Handy Conversion Charts, <i>Jerome A. Seiner</i> , 150 Controlling Small Flows of Liquids, <i>Roberto Alvarez R.</i> , 150 Formulas for Formed Head Characteristics, <i>P. V. Falchi</i> , 152
<b>YOU &amp; YOUR JOB</b>	The Thing You Lack Most Is Impatience, 154
<b>OPERATION &amp; MAINTENANCE</b>	Turnaround Maintenance, <i>Dana Cash</i> , 158 New Way to Move Lube Oils, <i>Charles Jackson</i> , 160
<b>CORROSION FORUM</b>	For Corrosives: Out-of-the-Ordinary Valves, <i>R. B. Wooster</i> , 162
<b>OTHER REGULAR FEATURES</b>	Firms in the News, 169 Convention Calendar, 179 More New Equipment Developments, 180 Technical Bookshelf, 188 Letters: Pro & Con, 190 Classified Section, 221 Equipment Searchlight, 222
<b>READER SERVICE</b>	Guide to Technical Literature, 194 Reader Service Postcard, 201 Reprints Now Available, 203 Advertisers in This Issue, 228

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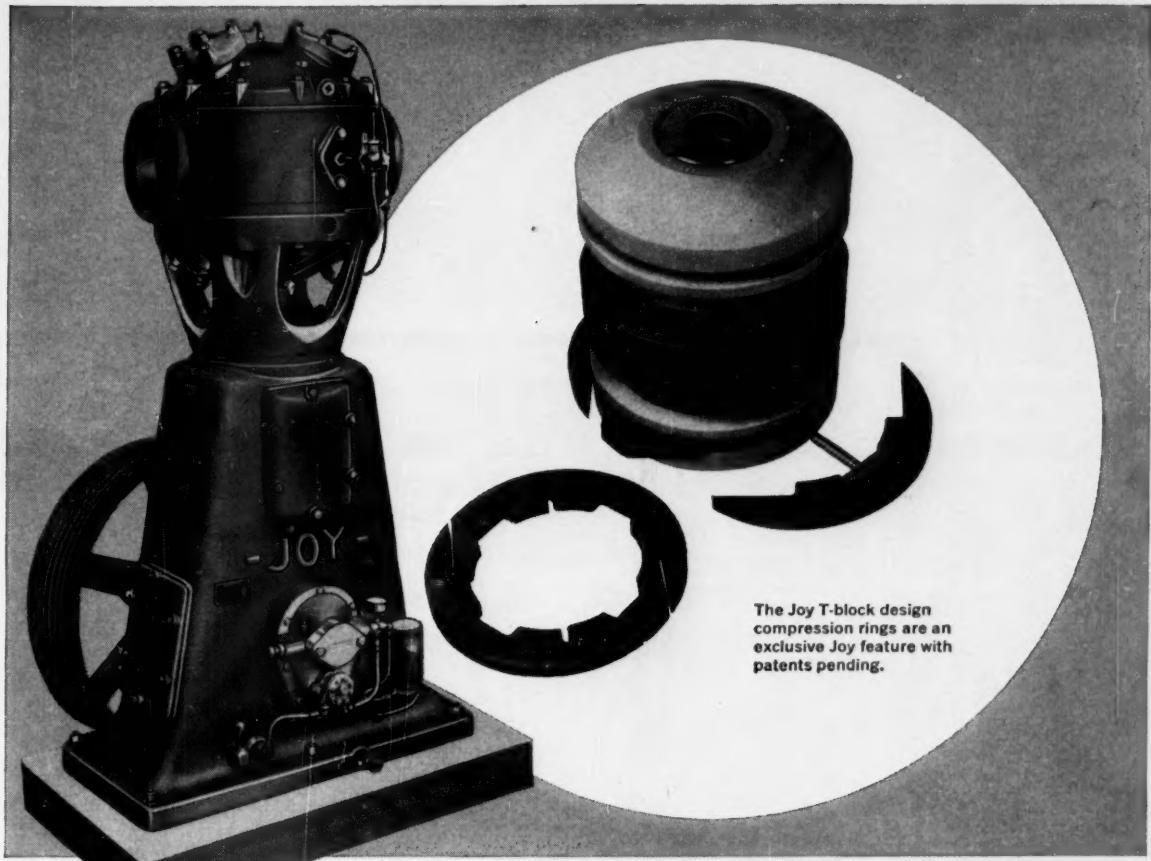
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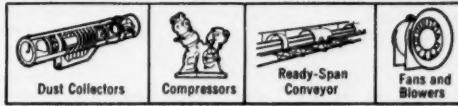
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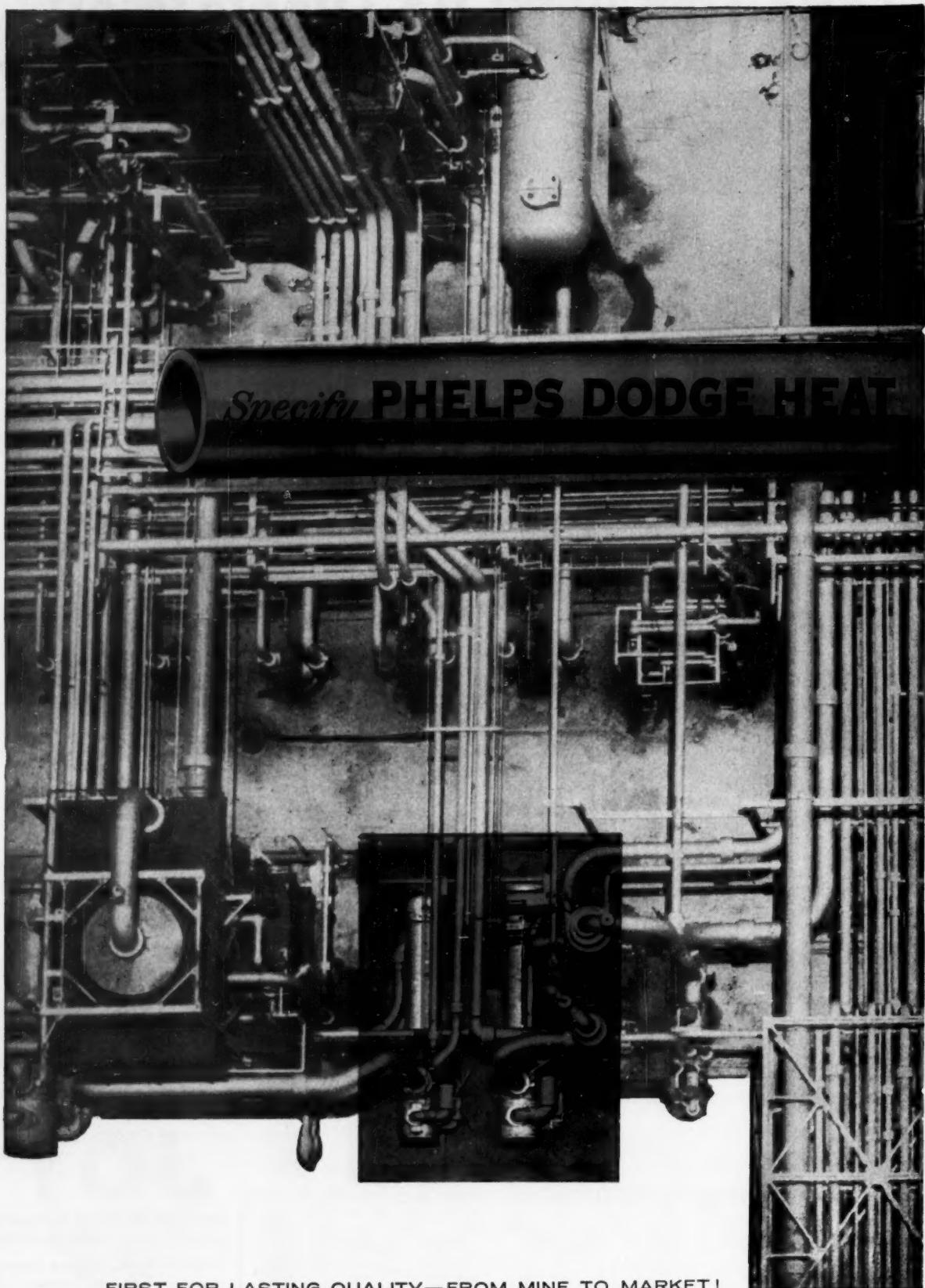
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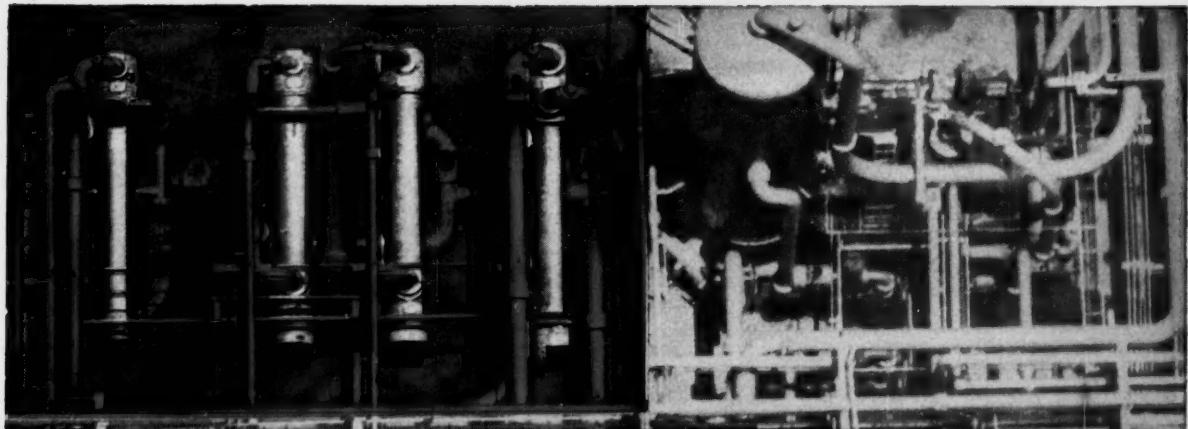
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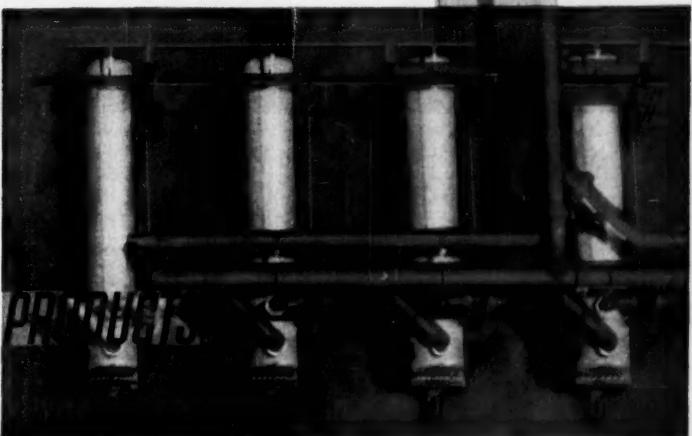
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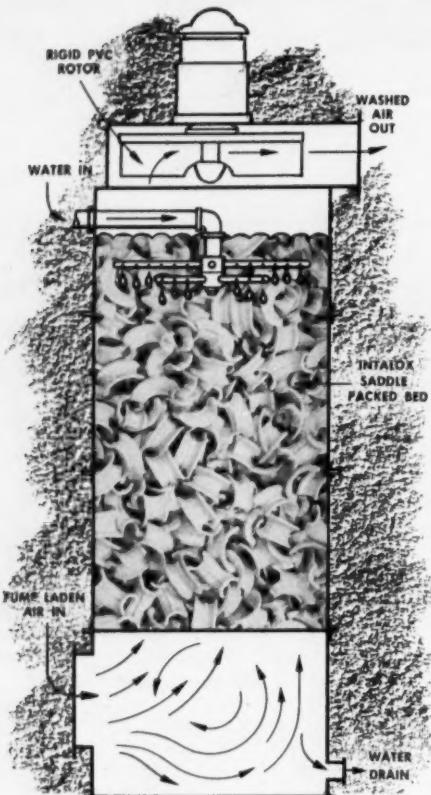
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On these two pages are illustrated and briefly described both standard and custom-built fume scrubbing units of our manufacture. Full engineering data is available on request. U. S. Stoneware's Engineering Department will be glad to work with you in designing fume removal systems to meet your specific needs.



## "CYCLONAIRE" Fume Washer

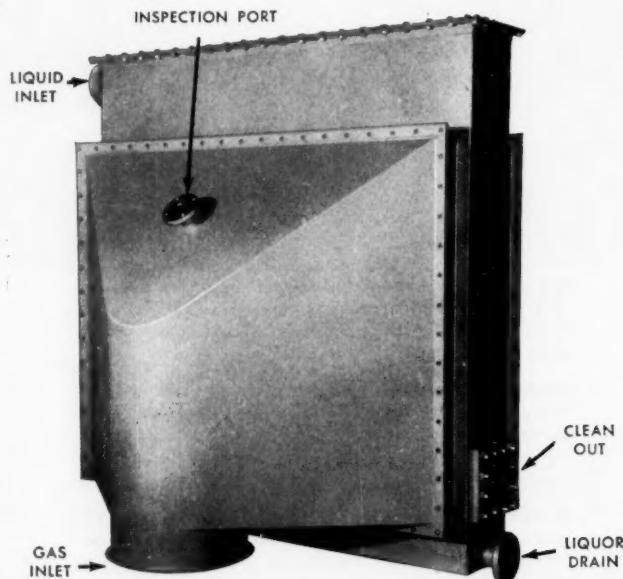
Designed primarily to handle relatively mild fume problems in laboratories, special departments, etc., the Cyclonaire is made in four sizes with rated capacities of 750, 1650, 3500 and 6000 cfm. It will effectively remove up to 99% of fumes (where the concentration of gases is 1% or less). The Cyclonaire comes complete with blower, motor drive unit, and Intalox Saddle Packing. The unit is constructed of 12 gauge steel, lined with 3/32" thick Tygon sheet plastic. The rotor is rigid polyvinyl chloride plastic. All exterior surfaces are protected with Tygon Paint.

The "Cyclonaire" can be equipped with mist or dust eliminators or provided with recirculating pumps. Two units can be arranged in parallel to handle additional cfm, or in series for heavier fume concentrations.

## The "CROSS-FLOW" Fume Scrubber

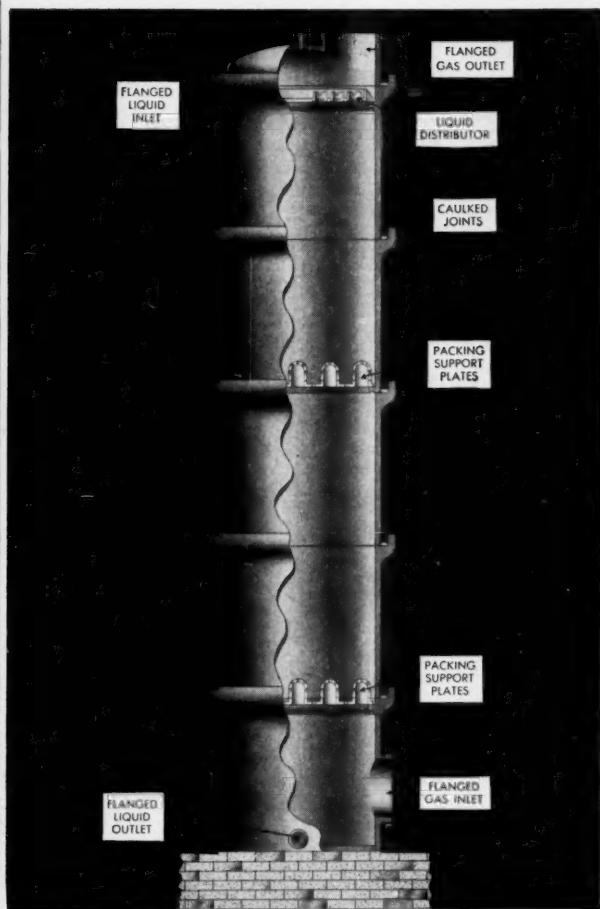
The "Cross-Flow" Fume Scrubber provides high efficiency in relatively small space. It is so designed that the gas flow and liquid flow are perpendicular to each other . . . the liquid flow vertical, gas flow horizontal. The effective liquid distribution over a cross-section area that is large in relationship to the thickness of the packed bed results in a highly active surface area capable of handling gases at high velocity rates with minimum pressure drop.

The "Cross-Flow" Fume Scrubber is built in six standard sizes with capacities ranging from 3,000 to 32,000 cfm. The unit is fabricated from heavy steel plate lined with 3/32" Tygon. Distributor is rigid plastic. The screen grid can be stainless steel or plastisol-covered wire mesh.



The unit illustrated above was designed for roof mounting, hence the gas inlet is located at the bottom. The unit, however, can be furnished with gas inlets located as desired.

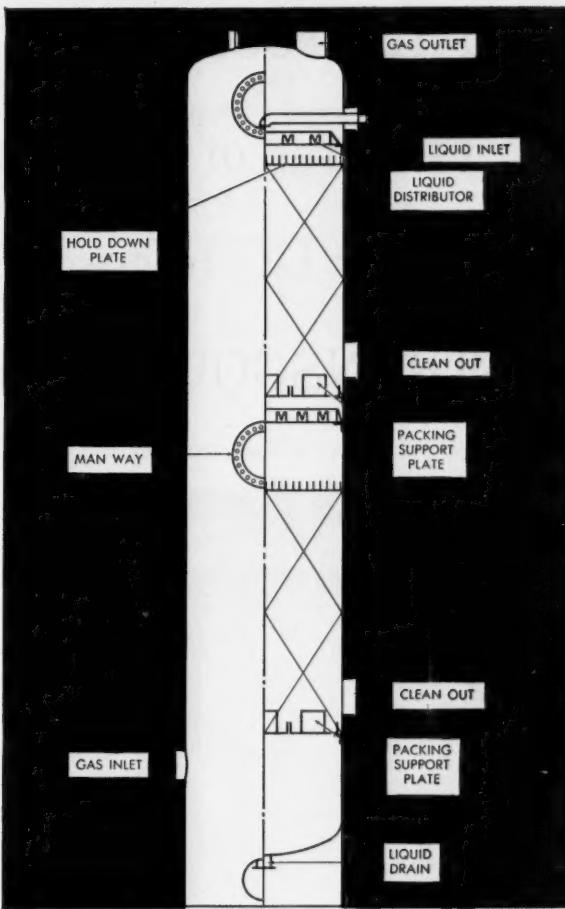
# FUME REMOVAL PROBLEMS



## Ceramic Fume Washers

For some applications, fume scrubbers made from chemical ceramics represent the best and most economical approach. Ceramic fume scrubbers can be provided in diameters up to 48", in heights up to 60 feet or more. Ceramic support plates, ceramic distributors, and ceramic pipe and fittings complete a virtually universal corrosion-resistant fume removal unit. Standard towers are made with bell-and-spigot construction or with cemented-on-metal flanges and are available in chemical porcelain, standard stoneware or "Ceratherm-550" heat-shock resistant stoneware.

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## Custom-built Metal Scrubbers

By far the largest number of fume removal applications involve the use of equipment custom designed and built to the user's specific requirements. The unit illustrated is typical of many such towers we have built in sizes ranging up to 8'-10" in diameter and as much as 80 feet high. The units may be lined with Tygon sheet lining or rubber, or unlined. Either metal, carbon, or ceramic support plates and distributors may be employed. Packing may be ceramic or carbon Intalox Saddles or Metal Pall Rings according to the nature of the gas and scrubbing agent.



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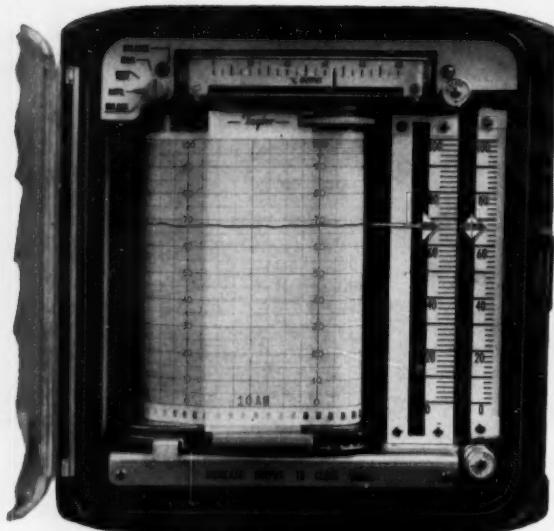
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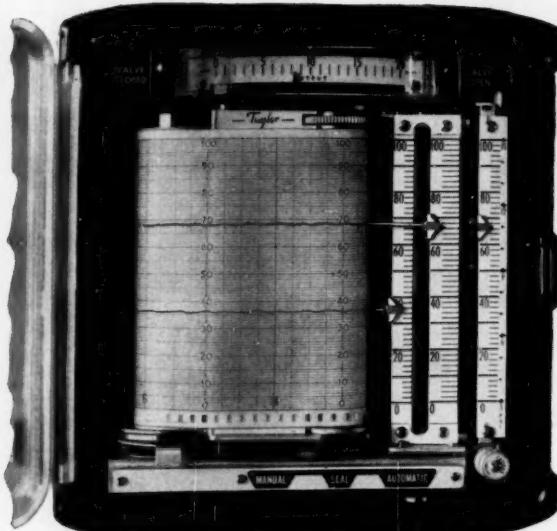
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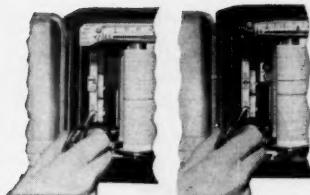
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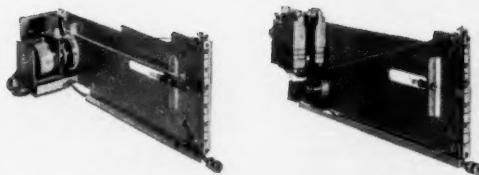
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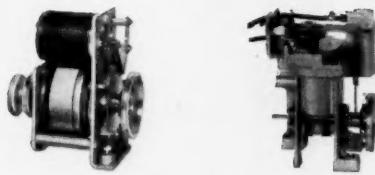
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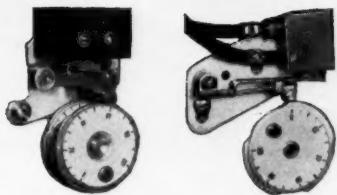
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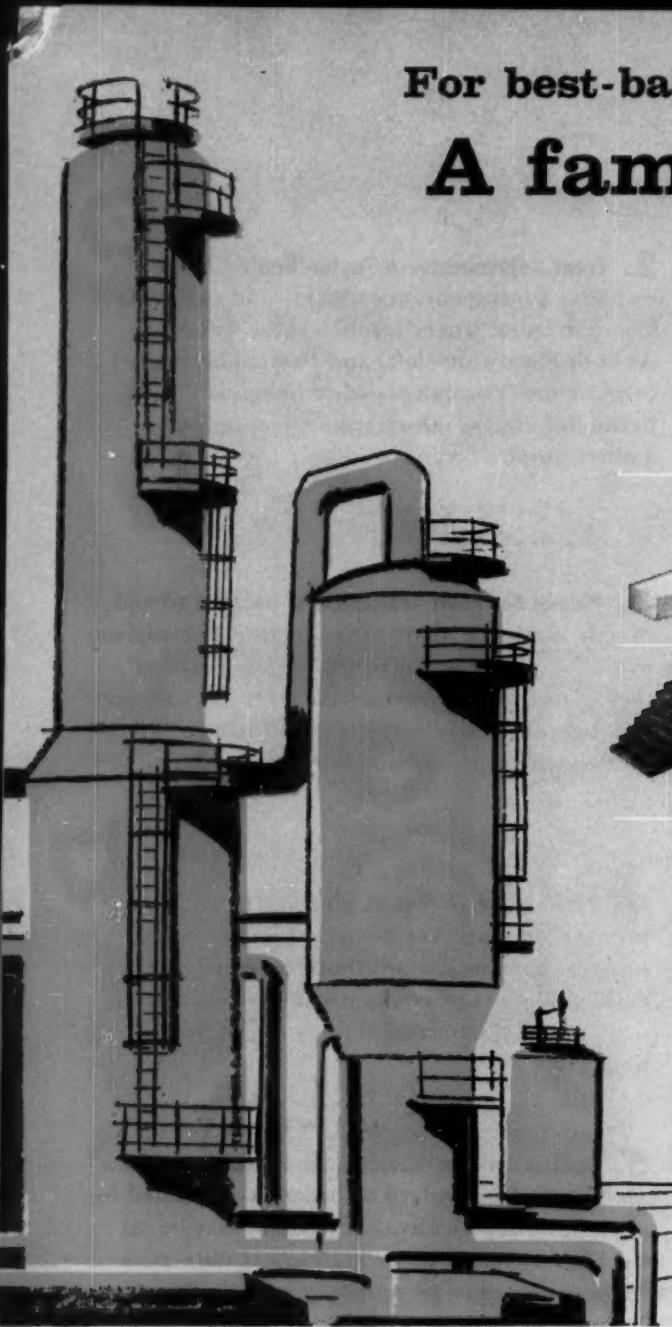


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Taylor Instrument Companies, Rochester, N. Y., and Toronto, Ontario.*

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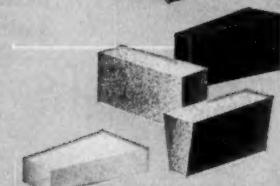
**MEAN ACCURACY FIRST**



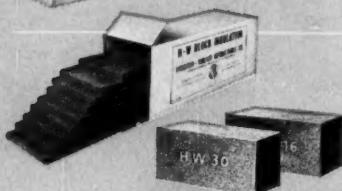
For best-balanced lining durability -  
**A famous family of**



**H-W CASTABLES AND  
OTHER MONOLITHIC  
REFRACTORIES**



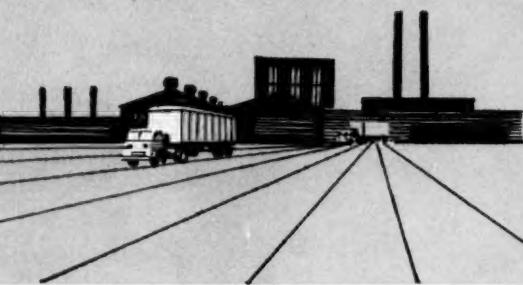
**H-W REFRACORY  
BRICK AND SHAPES**



**H-W INSULATING  
REFRACTORIES**



**H-W MORTARS**



**For maximum resistance to corrosion . . .  
chemical reactions . . . reducing atmospheres . . .  
over all temperature ranges**

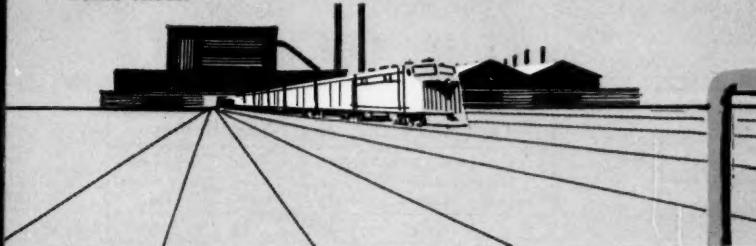
# quality refractories

Harbison-Walker monolith-forming refractories—including castables, plastic fire brick and ramming mixes—are widely favored for joint-free linings of petroleum refining and petro-chemical units of all kinds. Supplied in all commercial classes, they provide for the selection of the best refractories in the most desirable combinations of physical and chemical properties for each specific requirement.

Included in the many kinds of preformed refractories are all classes of fire brick . . . super-duty fireclay brick . . . high-alumina brick including all classes from 50% to 99+% alumina . . . silica brick . . . basic brick . . . acid-proof brick, floor tile, tower packing rings and grid tile.

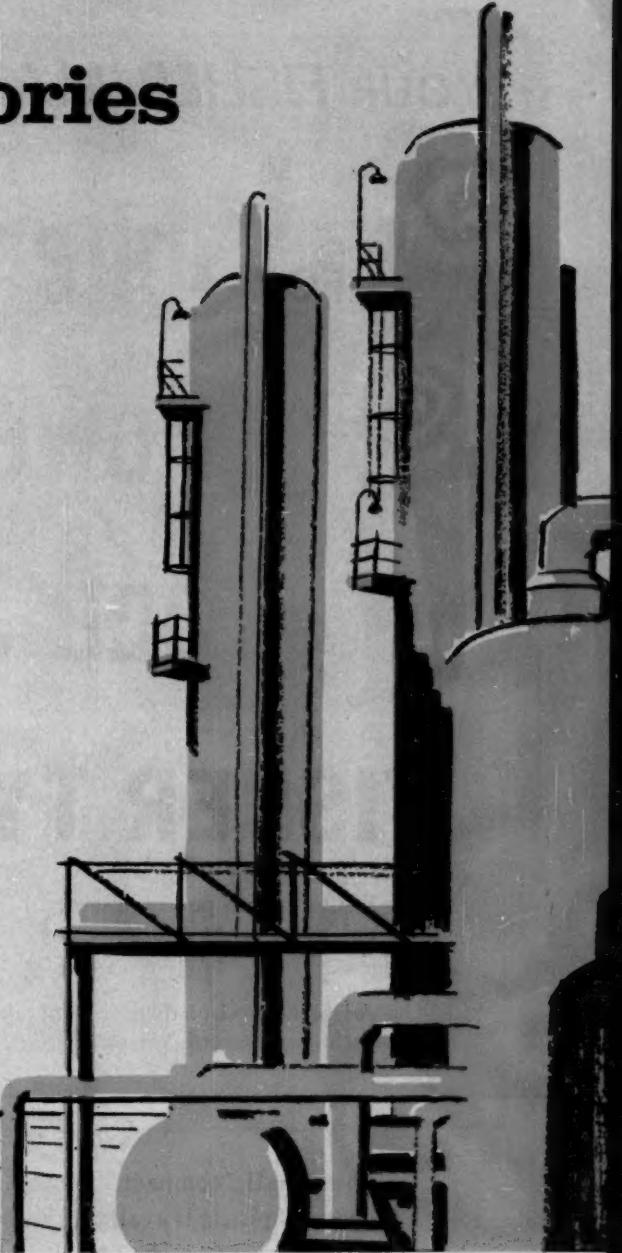
These comprise eight classes of insulating fire brick with service limits ranging from 1600°F. to 3000°F. . . . corresponding mortars . . . various brands of castable insulating refractories . . . H-W BLOCK INSULATION . . . H-W MINERAL FIBER COATING . . . AND H-W FINISHING CEMENT.

For every precise need there are available air- and heat-setting cements, especially suited for laying every kind of refractory brick including alumina-silica through low, medium and high-heat duty and super-duty fireclay brick, all the different brands of high alumina, basic and silica brick. HARWACO MASTIC is a plastic heat-setting mortar of stiff consistency, which most satisfactorily fulfills the requirement for sealing V-shaped spaces at the exterior faces of tangential boiler tubes.



Harbison-Walker produces all the types and classes of refractories needed to meet the highly-specialized requirements of today's refinery and petro-chemical processing operations. Properly selected, they assure maximum corrosion resistance to various sulphur compounds and hydrocarbons . . . withstand severe fluxing effect of oil ash and resist abrasion, erosion and disintegrating actions of reducing atmospheres through critical temperature ranges.

The Harbison-Walker Technical Service Department freely offers assistance in the selection and use of the refractories that will best serve your particular application with greatest overall economy. Nearby manufacturing plants and warehouses help you realize added economies in transportation time and cost.



*World's Most Complete  
Refractories Service*



**HARBISON-WALKER  
REFRACTORIES COMPANY and Subsidiaries**  
GENERAL OFFICES: PITTSBURGH 22, PA.

YOUR **FISHER/MAN** STANDS BEHIND THIS



FOR **Inherent Accuracy-**  
**Power-Speed-**  
**and Stability**

## **FISHER TYPE 470 P.O.P.**

Delivers same power in either direction at any point of the stroke.

Adaptable to virtually all types of valve bodies including Butterfly valves.

No air set required—utilizes clean, noncorrosive air or gas up to 150 psi.

Easily reversible actuator can be changed in the field.

This small, compact, pneumatically operated piston is available in five sizes with yoke sizes to fit any of the Fisher valve bodies including Butterfly valves. P.O.P. acts with high speed. For example, the 8½-inch size gives you 1.5 inches per second stroking speed. Write Fisher Governor for Bulletin E-59.

Type 470 P.O.P. With Fisher Bodies				
Cylinder Size, Inches	Yoke Boss Size, Inches	Valve Body Size, Inches	Stem Size, Inches	Allowable Stem Force, Lbs.
4 ¾	2 ½	½—1 ½	¾	1,500
	2 ½	2—4	½	*
	3 ½	5—8	¾	*
6 ½	2 ½	2—4	½	2,500
	3 ½	5—8	¾	*
8 ½	3 ½	5—8	¾	5,000
10 ¾	5	10—16	1	8,000
13	5	10—16	1 ¼	12,000

\*Limitation with these stems is dependent upon the maximum force available from each cylinder.



IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD... CHANCES ARE IT'S CONTROLLED BY...

**FISHER GOVERNOR COMPANY**

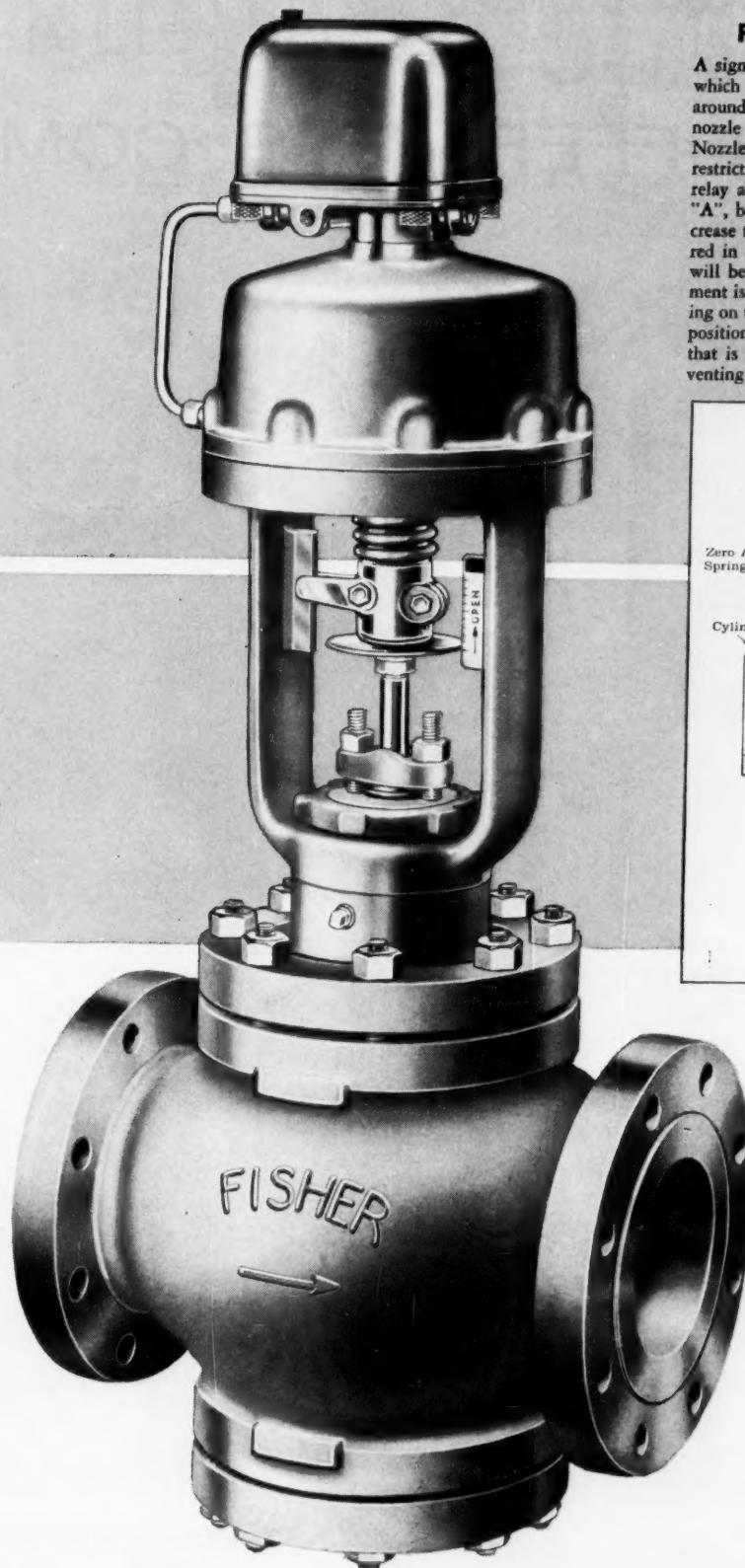
Coraopolis, Pa. / Woodstock, Ontario / London, England

Main Office and Plant: MARSHALLTOWN, IOWA



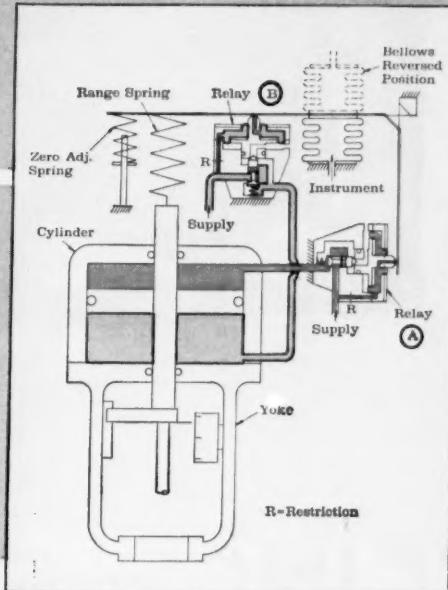
SINCE 1880

# PNEUMATICALLY OPERATED PISTON...



## PRINCIPLE OF OPERATION

A signal from the controller is received by the bellows which expand to move the beam. The beam will pivot around the fixed point and simultaneously uncover the nozzle of Relay "B" and cover the nozzle of Relay "A". Nozzle pressure will increase in Relay "A" due to the restriction created by the beam over the nozzle. Through relay action, the air pressure to the top of the piston, "A", black in the sketch, will be increased. Relay "B" will increase the pressure to the under side of the piston, "B", red in the sketch. Due to the unbalanced pressures acting on the piston, it will move down, changing the valve position as dictated by the controller. The piston movement is connected to the piston rod extension thus preventing any further build-up of pressure in the cylinder.



Exterior view of high pressure actuator, Type 470 mounted on a Design "A" body.

# Specialists in Liquid-

## OFFER THIS COM



### Tolhurst®

#### CENTRIFUGALS

- BATCH-O-MATIC®
- BATCH-MASTER®
- SUSPENDED
- CENTER-SLUNG®
- MAXI-FLEX®
- CONTINUOUS

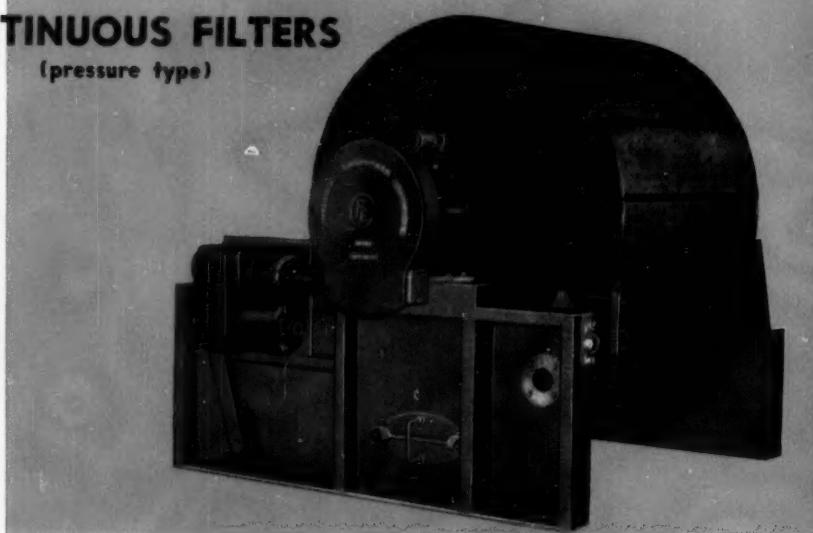
### FE INC®

#### CONTINUOUS FILTERS

(pressure type)

Custom Engineered

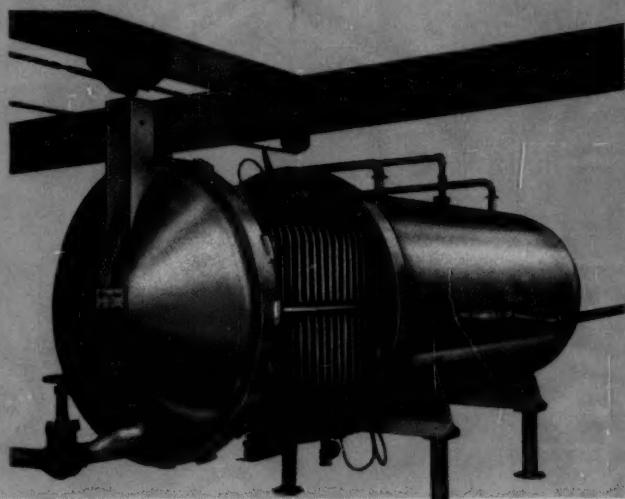
- VACUUM
- OR
- PRESSURE
- ROTARY DRUM
- HORIZONTAL
- TABLE



# Solids Separation

COMPLETE UNBIASED SERVICE

Niagara<sup>®</sup> FILTERS



- VERTICAL LEAF MODELS in both horizontal and vertical tank designs.
- BATCH-MISER<sup>®</sup> horizontal plate models for polish filtration and batch operations.
- ALL ASME Code Construction.

FEON<sup>®</sup>

Available by the roll or tailored to fit all types of fluid/solid separation process equipment.

- NATURAL AND MAN-MADE FILTER MEDIA

FEON Woven Textile Fiber Fabrics

FEON Non-woven Textile Fiber Fabrics

FEON Filter Papers by Rochester Paper Co.

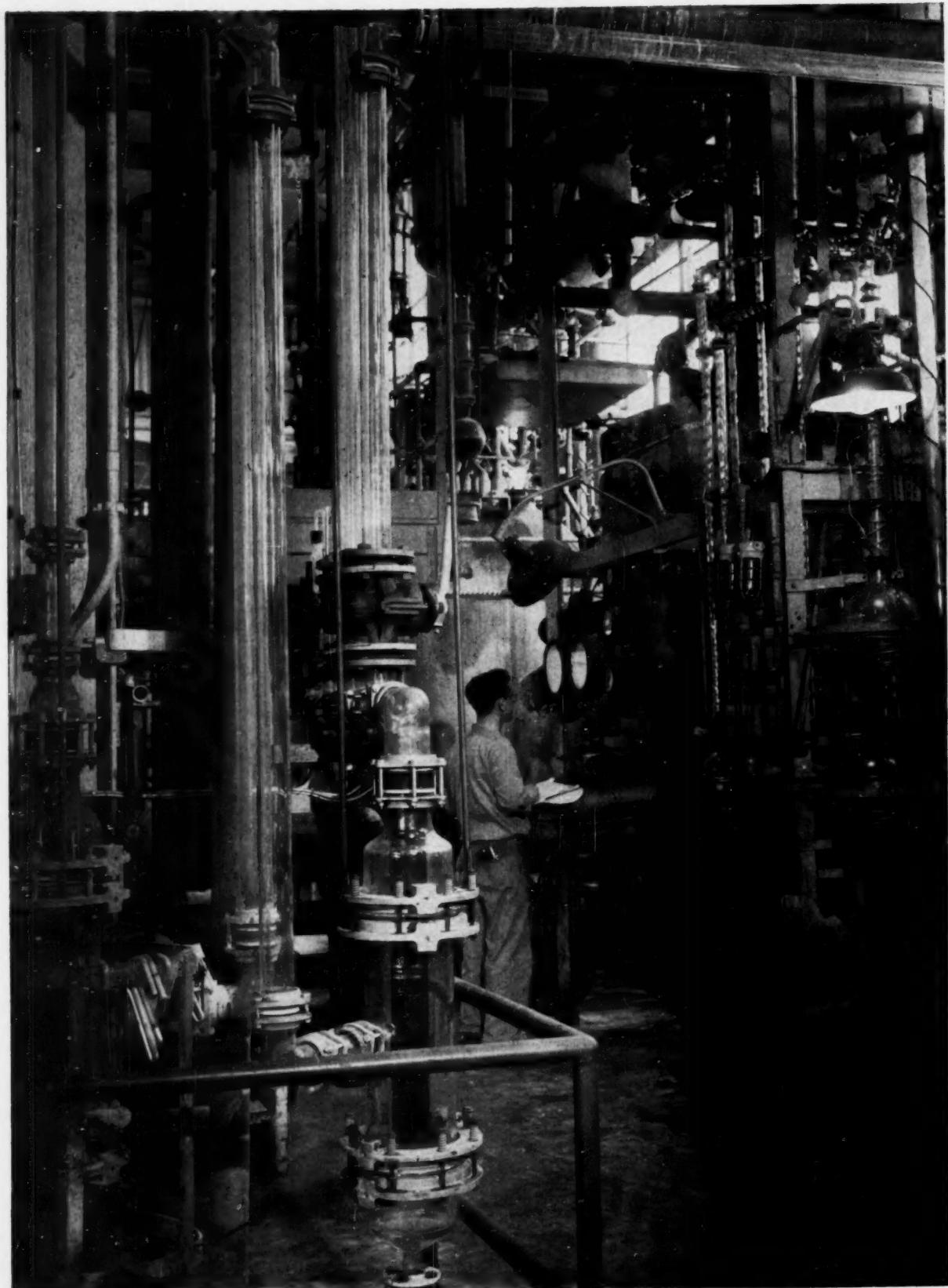
• Laboratory Tested • Production Proven

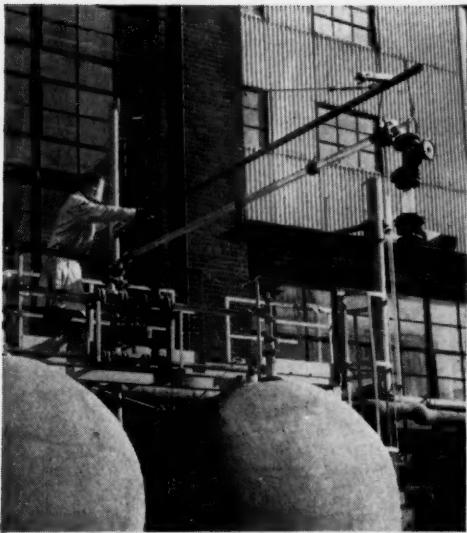
Write for literature. Please specify: TOLHURST . . . FE<sup>INC</sup> . . . NIAGARA . . . FEON

DIVISIONS OF

American Machine and Metals, Inc.  
EAST MOLINE, ILLINOIS

COMPLETE LABORATORY TESTING FACILITIES AT YOUR SERVICE





Special swivel booms of glass, along with 200 feet of 2-inch PYREX brand glass pipe, handle organic acid chlorides at this outside storage and unloading station.

At the Trubek Laboratories, Incorporated, East Rutherford, N. J., 1000 feet of 1-inch and 200 feet of 2-inch PYREX brand glass pipe are used in a four-component continuous reaction system for handling chlorine, HCl, and corrosive organics.



It's easy to install. Almost any plumber, or your own maintenance men, can install glass pipe, quickly and easily.



Now available: The new PYREX brand glass Y-valve in 1½" and 2½" sizes. Write for Bulletin PE-4.

Inside  
and  
out...  
at Trubek Labs they

## TAME TOUGH CORROSIVES with PYREX® glass pipe

INSIDE Trubek Laboratories, Inc., you'll find a four-component continuous reaction system for handling chlorine, HCl, and a number of corrosive organics.

Part of this system is piping—1000 feet of 1-inch and 200 feet of 2-inch PYREX brand glass pipe. Also included are PYREX brand glass Y-valves and Shell and Tube Heat Exchangers.

OUTSIDE at Trubek, you'll see an acid chloride storage system and tank truck unloading station. Here you'll find an additional 200 feet of 2-inch PYREX pipe, as well as special swivel booms made from glass.

Why does Trubek pick glass pipe for taming tough corrosives? Because this pipe is made from PYREX brand glass No. 7740. This is the glass that is resistant to more acids and acidic materials than any other pipe. It's the same glass in which laboratory tests for the chemical durability of other corrosion-resistant materials are generally carried out. And you are assured of product purity because PYREX pipe does not contaminate even the most sensitive product.

And, you can see what's going on in every inch of PYREX pipe. Should blockage occur—a rare happening because glass is so smooth—you can quickly spot it, without costly downtime and dismantling.

Is glass pipe fragile? Not PYREX pipe because it's made to stand up to high temperatures, pressure, and considerable mechanical shock.

How about costs? If you consider that installing glass often requires less time than other materials, you can start with at least one saving. But the big economy comes from the fact that glass lasts. Example: One firm reports that, after 9 continuous years of piping chlorine through 1600 feet of PYREX pipe, they had no corrosion at all. And maintenance had cost only \$6.32 per year.

Why not put all the facts and figures about pipe for handling corrosives at your finger tips. Send for Bulletin PE-3, "PYREX brand 'Double-Tough' Glass Pipe and Fittings." Use the coupon for quick action on your request.

CORNING MEANS RESEARCH IN GLASS

**CORNING GLASS WORKS**

1 Crystal Street Corning, New York

Please send me:  PE-3, the manual on PYREX brand glass pipe.  
 PE-4 on the all-glass Y-valve.

Name.....

Title.....

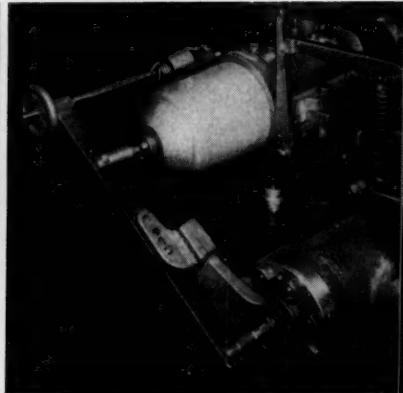
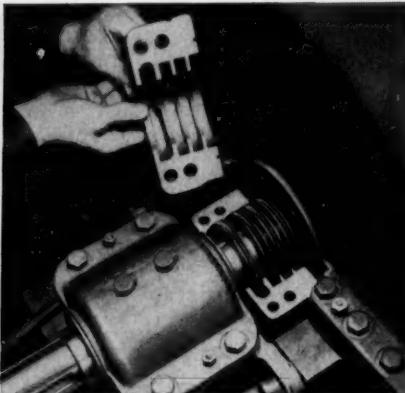
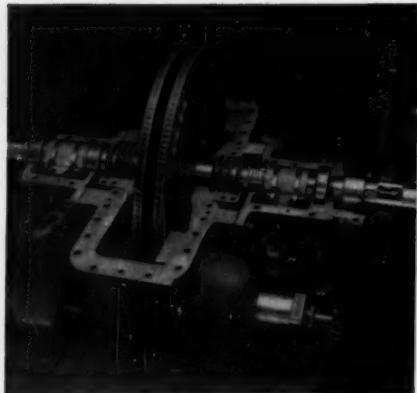
Company.....

Address.....

City..... Zone..... State.....

*Economical  
in operation...  
Dependable  
always*

# ELLIOTT



*Precise alignment of shaft, through true centerline support, permits smooth and dependable operation at all operating temperatures. The entire rotor assembly is dynamically balanced.*

*Accessible shaft-seals simplify maintenance and routine inspection. Shaft surface under packing glands is stainless steel. Covers are readily removable without disturbing the upper-half casing.*

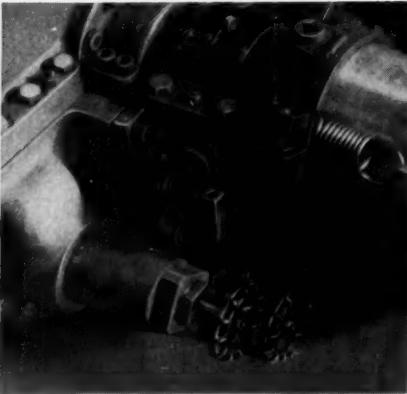
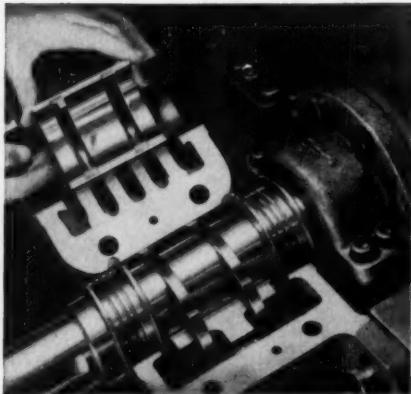
*Simple, Positive direct-acting speed-governing system is dependable, weather-proof, accurate. Separate trip gives positive overspeed protection, and it may be easily reset against line pressure.*

## Only ELLIOTT Turbines give you all these PLUS features

*By separating the pedestal-mounted exhaust-end bearing from the hot turbine casing, the temperature distortion is minimized, and the vertical shaft movement is thereby eliminated.*

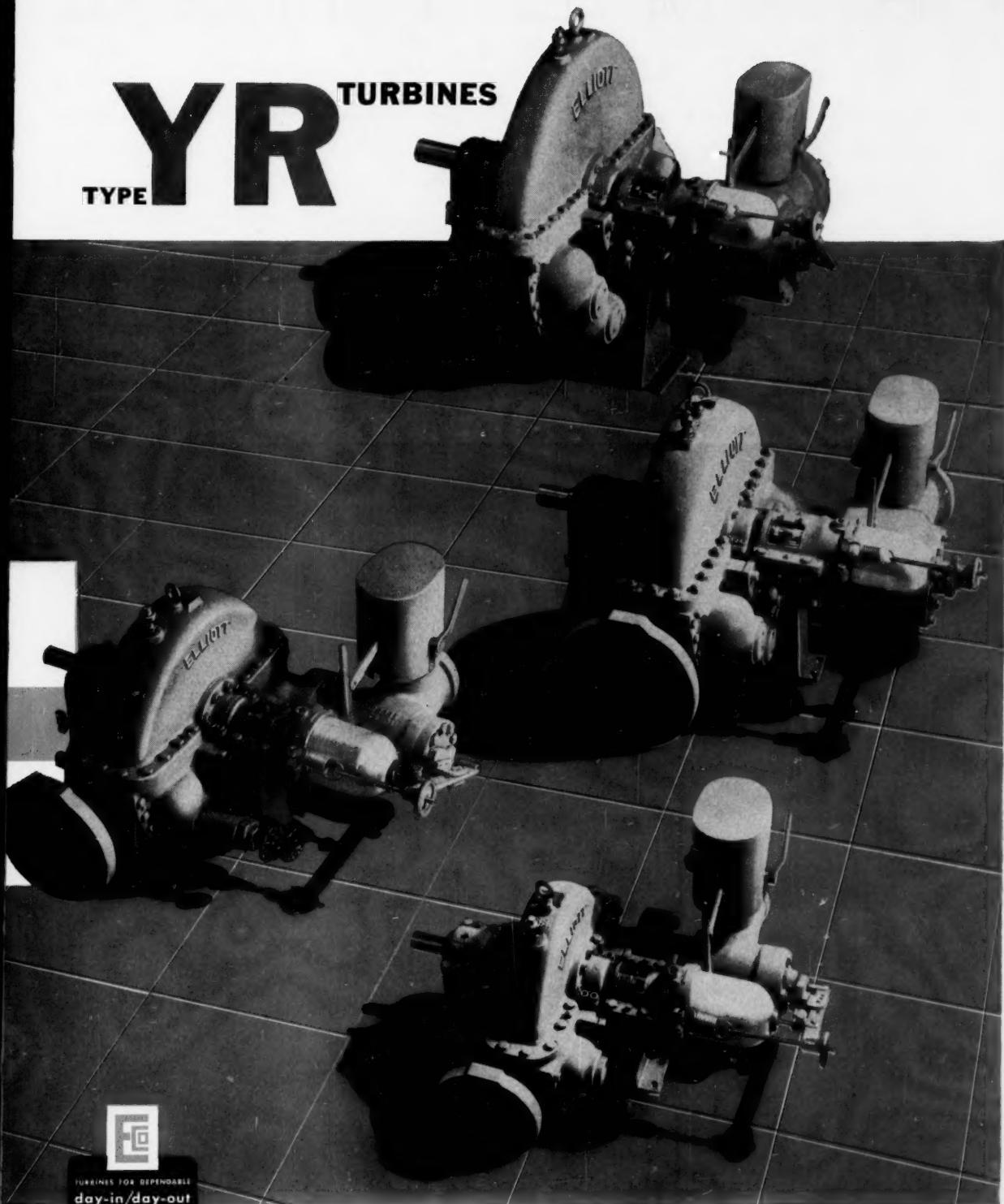
*Steam-saving hand valve with pilot, which can be opened against full steam pressure, reduces steam consumption at partial loads. This feature is available on all sizes of Elliott YR steam turbines.*

*All-weather protection is standard for Elliott YR turbines. They shrug off heat, dirt, snow, moisture or contaminated atmosphere. Stainless steel exposed parts are furnished for extreme conditions.*



*In addition to the units illustrated here, Elliott makes single-stage turbines in special frames, reduction gears, multistage mechanical drive turbines to 50,000 hp, and turbine-generators ranging through 44 mw.*

# TYPE YR TURBINES



H9-1

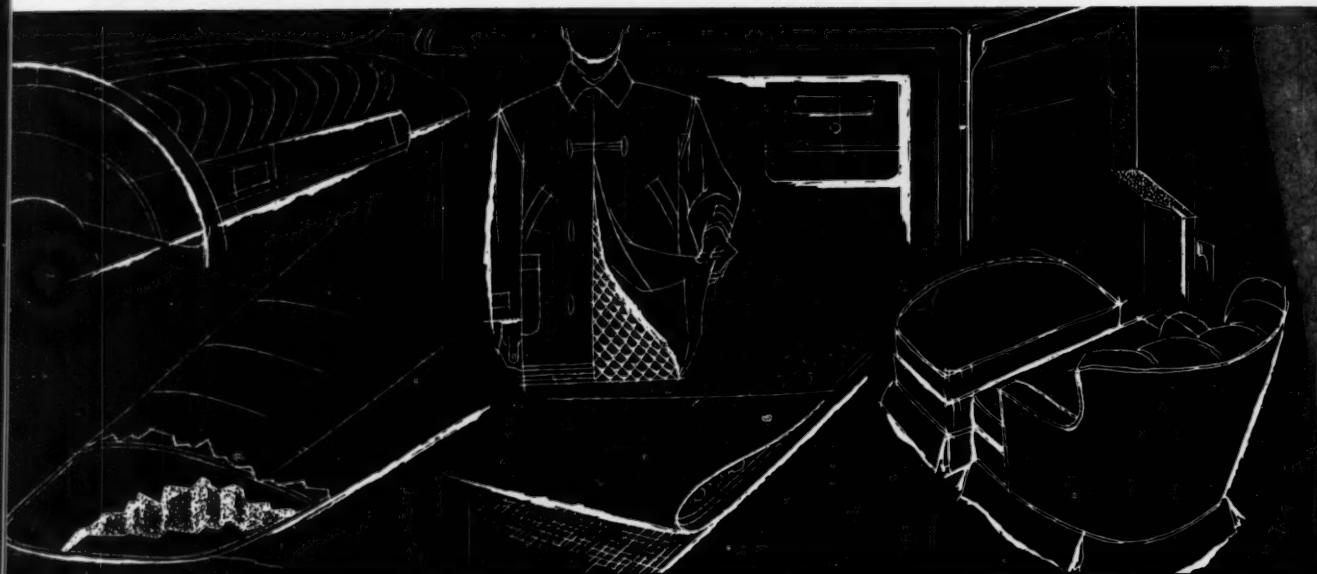


**ELLIOTT Company**

JEANNETTE, PENNA.

# TRIMETHYL

Celanese high volume production  
and low price...putting bounce  
in urethane foams and coatings industries



*Left to right:*

- CRASH PADDING
- AIRCRAFT CONSTRUCTION
- CLOTHING INTERLINERS
- RUG UNDERLAYS
- REFRIGERATOR INSULATION
- FURNITURE CUSHIONING
- AUTOMOBILE CUSHIONING
- PROTECTIVE PACKAGING
- MATTRESSES AND PILLOWS
- ARCHITECTURAL PANELS

# OL PROPANE

To make urethane foam, rigid or resilient, you need a polyol. This is where an increasing portion of Celanese' 15 million lbs. capacity of trimethylolpropane is going, and where the Celanese low price is helping manufacturers of urethane foams and coatings to flatten costs and meet the competition of other materials.

The same with alkyd resins—another end use where Celanese trimethylolpropane's high production and low price have enabled paint and coatings manufacturers to plan ahead with more confidence.

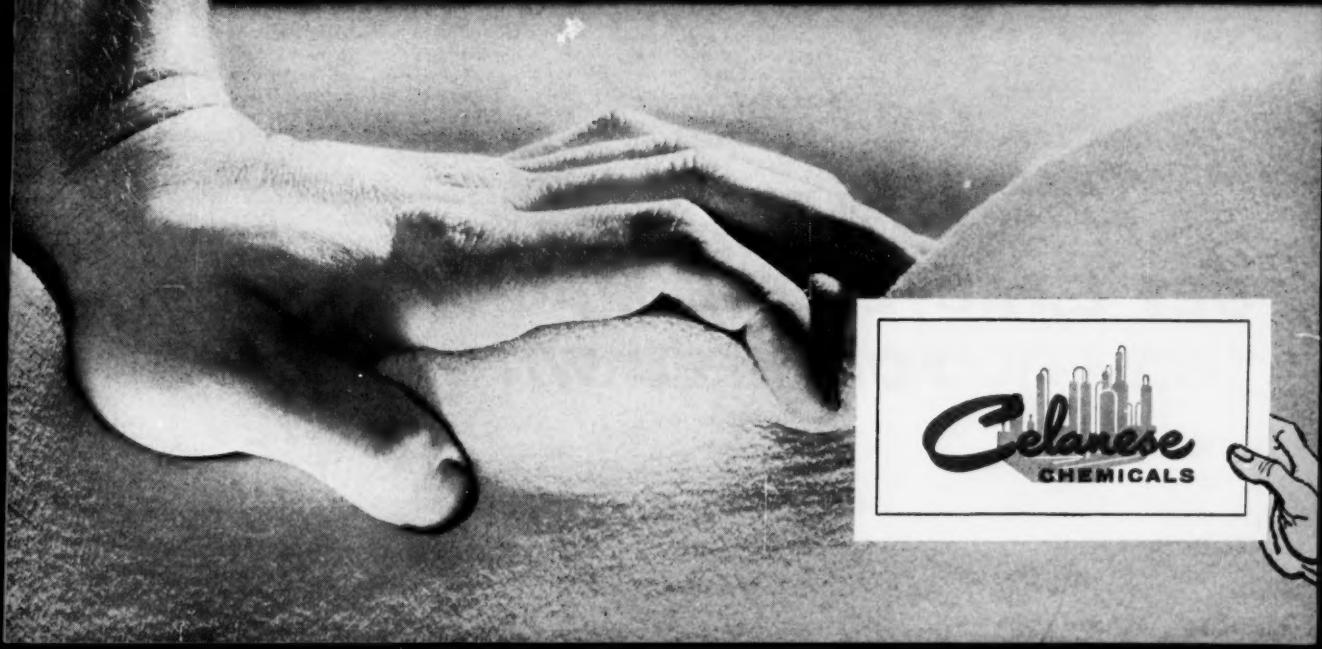
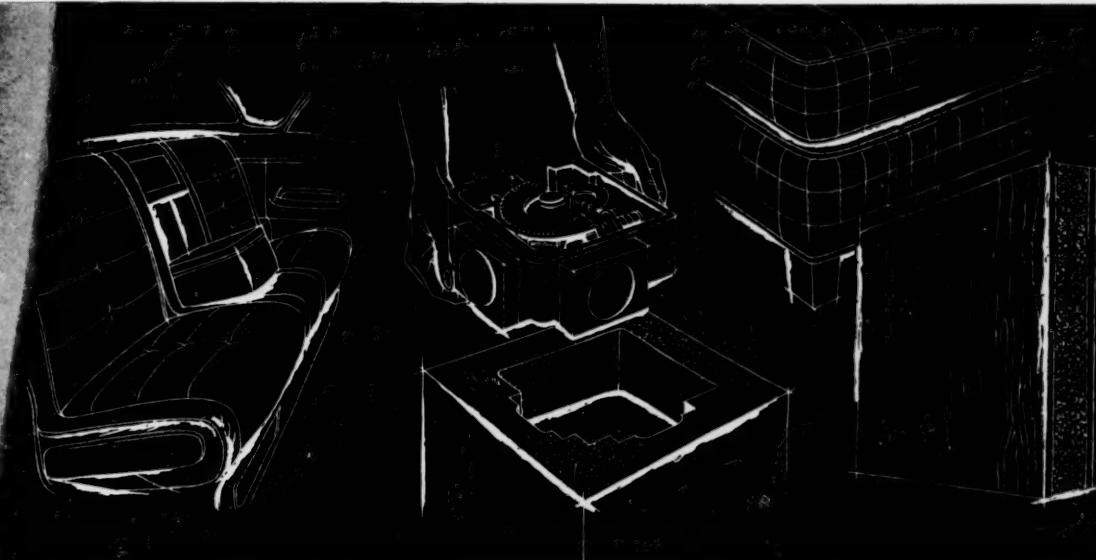
Giving dependability to your raw material supply source is a continuing program at Celanese.

Celanese Corporation of America, Chemical Division, Dept. 553-D, 180 Madison Ave., New York 16.

*Canadian Affiliate:* Canadian Chemical Company Limited, Montreal, Toronto, Vancouver.

*Export Sales:* Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Avenue, New York 16, N. Y.

Celanese®





**Fred Wheelwright,**

**Manager, Industrial Sales:**

"We're taking this opportunity to tell you something about

how De Laval makes sure you get *exactly* the *right machine* for your processing needs.

Within reasonable limits, our engineers can predict how a material will behave under differing process conditions, but *only* within limits. When it comes right down to the line, every separation job and every processing operation is unique, capable of vital differences that can throw the whole process off if not taken into account beforehand.

"These panels deal with some of our methods for insuring dependable, predictable, and accurate results in processing with De Laval equipment. This is the story of how we make sure that you get *exactly what you need* every time you order De Laval Process Equipment."

For further information, write to De Laval.



Dept. C-2

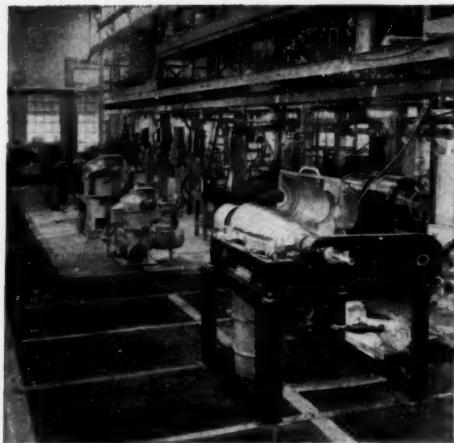
**THE DE LAVAL SEPARATOR COMPANY**

Poughkeepsie, New York

5724 N. Pulaski, Chicago 46, Illinois

**DE LAVAL PACIFIC COMPANY**

201 E. Millbrae Avenue, Millbrae, California



**DESIGN AND APPLICATION TESTS**

**GUARANTEE THE RIGHT CENTRIFUGE**

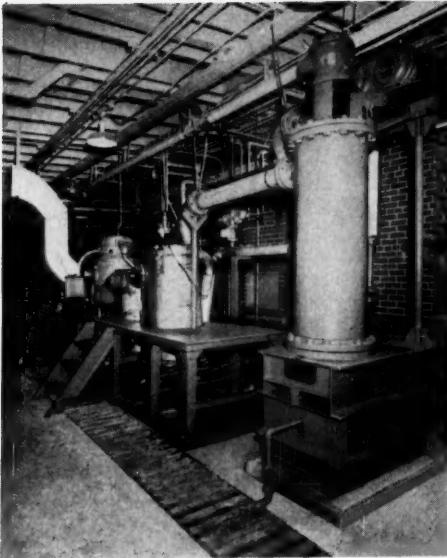
**FOR YOUR OPERATION**

This is the De Laval Test Plant. It is here that the mechanical design of every new De Laval centrifuge is meticulously tested. Tests cover metal stress, mechanical wear, capacity and throughput pressures and other determinants of mechanical dependability in actual field operation. The tests are always more severe than the conditions for which the machine is designed. It is only when De Laval engineers are satisfied that the machine exceeds the performance standards at which it will be offered to industry that it is cleared for production.

Every mechanical modification of the machine will send it back through the same rigorous testing.

Related to the Test Plant is De Laval's Pilot Plant. With stages for mixing, reaction, heating, and three stages of separation, the Pilot Plant provides a complete centrifugal processing facility in which you can test your processes without having to build your own pilot plant. It is here, also, that De Laval engineers have developed complete processes replacing older methods and equipment. The next panel gives details on one of these developments, the patented De Laval Tall Oil System.

**GET EXACTLY THE MACHINE  
YOU NEED WITH DE LAVAL**



**CONTINUOUS TALL OIL PROCESS...  
HOW A PROCESS WAS ADAPTED  
TO THE EQUIPMENT  
WITH PHENOMENAL SUCCESS**

In developing the continuous Tall Oil Process, De Laval engineers adapted a process to equipment already at hand and made the operation more profitable with a better product, higher recovery and lower costs.

At the heart of the system, two De Laval AC-VO "Nozzle-Matic" centrifuges (illustrated above at St. Marys Kraft Corp., St. Marys, Ga.) continuously separate tall oil and concentrated salt cake liquor. This is the final stage of a 4-5 minute pass through the complete process. Note the contrast to the former batch method. Time required ran from 18 to 30 hours for a single batch and there was nothing like the control and certainty of the De Laval system.

Here is a case where a proven De Laval centrifuge was applied to a new process, developed through De Laval research. In this and other De Laval complete processes, De Laval's Pilot Plant and engineering staff have found a better way to make a better product at less cost.

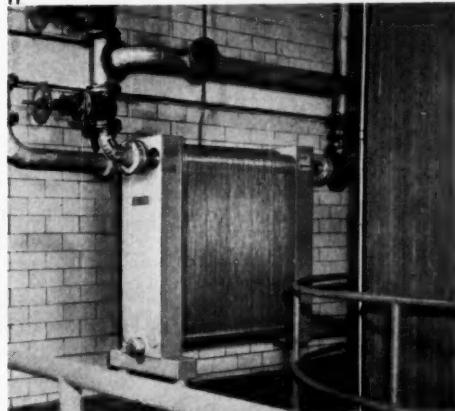
**RECOVERS AND RE-USES MORE THAN  
12 MILLION BTU's PER HOUR  
FROM NORMALLY WASTED SOURCE**

This De Laval Plate Heat Exchanger is doing an exceptional job for Finch, Pruyne & Company, Glens Falls, N. Y. Handling more than 110,000 lbs. per hour of 170° F spent sulfite liquor which was formerly dumped, it pre-heats 100,000 lbs. per hour of filtered river water.

The filtered water is preheated from 40° F to 150° F as it passes in juxtaposition to the spent sulfite liquor, which is cooled to a discharge temperature of 60° F.

This highly profitable recovery of heat is accomplished in a remarkably small unit. Only 800 sq. ft. of heat transfer surface are required to recover the more than 12,000,000 BTU's per hour. Actual size of the unit is 11'8" x 2'9" x 6'2".

The amazingly high heat transfer coefficient of De Laval Plate Heat Exchangers makes heat recovery both practical and profitable. On the average, a De Laval Plate Heat Exchanger requires but one-fourth the transfer surface of a shell and tube exchanger operating at equal throughput capacity. And, a De Laval unit will perform to far more exacting standards, with greater efficiency.

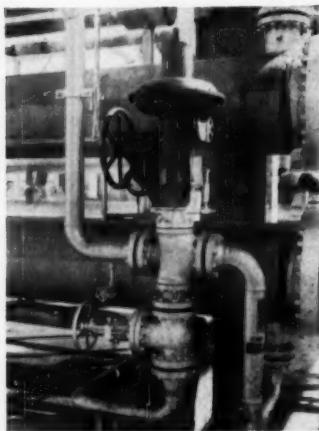


## **PROCESS EQUIPMENT**

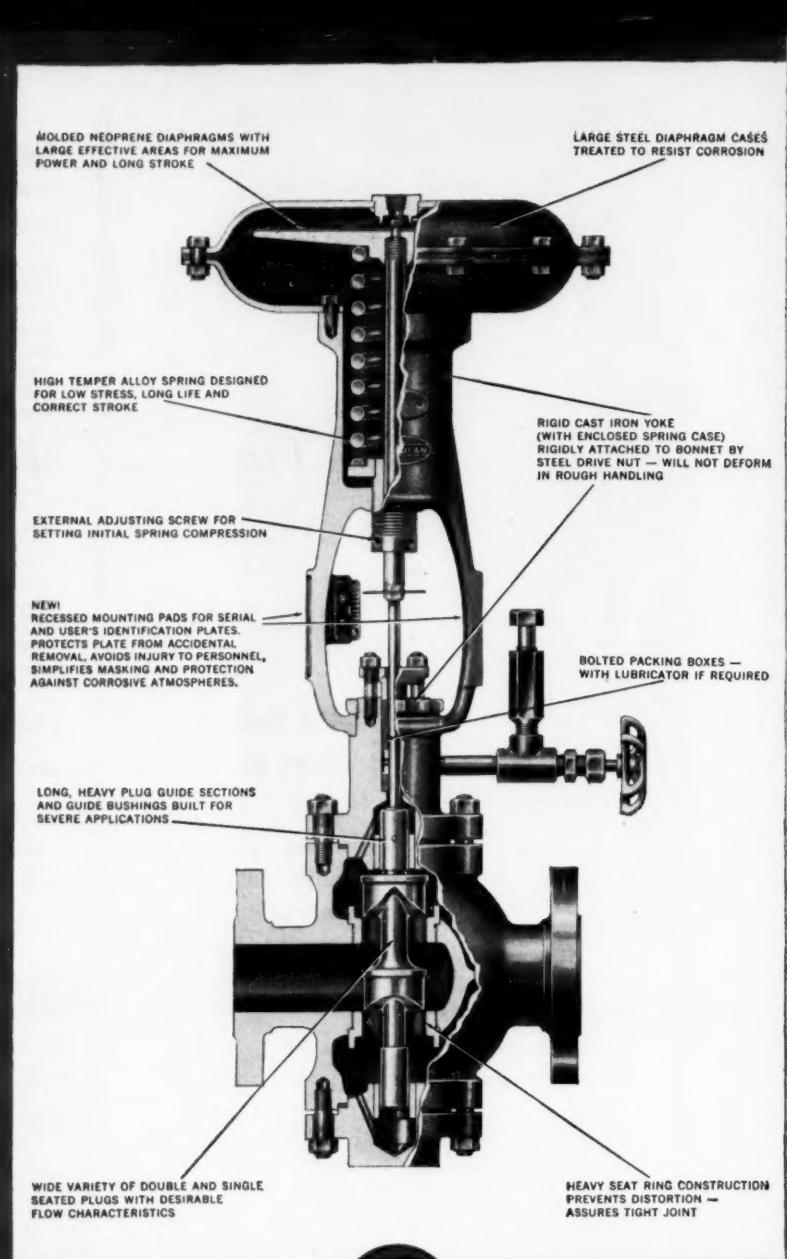
**CENTRIFUGES  
PLATE HEAT EXCHANGERS  
VIBRATING SCREENS  
COMPLETE PROCESSES**



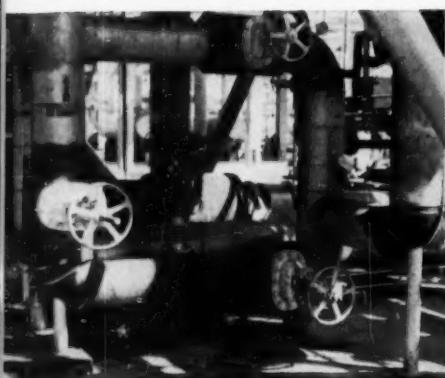
Crude Charge to Furnace



Reactor Effluent Flash Drum Control



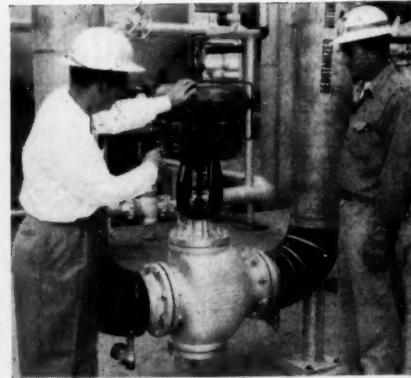
A HIGH PRODUCT



Cat-Cracker Feed Control



Gas to Fuel Drum and Flare Drum



Debutanizer Bottoms Control

*In the Final Control Element . . .*

## **ACCURACY AND DEPENDABILITY ARE KEY QUALITIES**

**That's Why So Many Process Plants  
Standardize on Mason-Neilan Control Valves**

Many process control systems — in chemical, paper, petroleum, petrochemical, textile and other plants — use Mason-Neilan Control Valves exclusively because experience has proved that Mason-Neilan valves are accurate and dependable. And because they give this top performance over long periods, they are most economical.

The wide variety of applications pictured here

are in one modern petroleum refinery which uses Mason-Neilan valves. There are Mason-Neilan types for practically all control systems in all other processing plants, too. If you are concerned with the selection of control valves, it will pay you to consider Mason-Neilan.

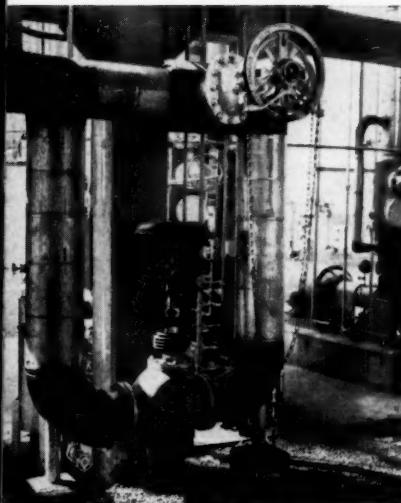
Complete details on control valves for every process use are yours for the asking. Write for catalog.

## **MASON-NEILAN**

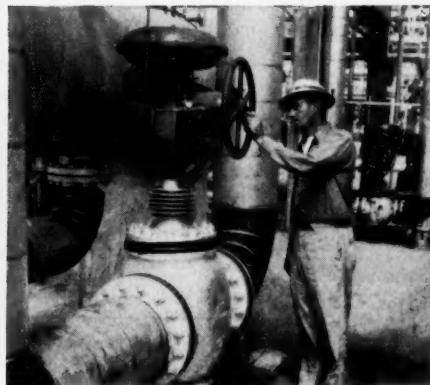
*A Division of Worthington Corporation*

**67 NAHATAN STREET, NORWOOD, MASSACHUSETTS**

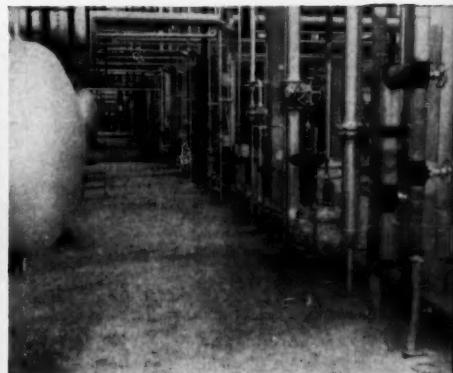
*District offices or Distributors in principal cities in U.S.  
In Canada: Mason-Neilan, Division of Worthington (Canada), Ltd.*



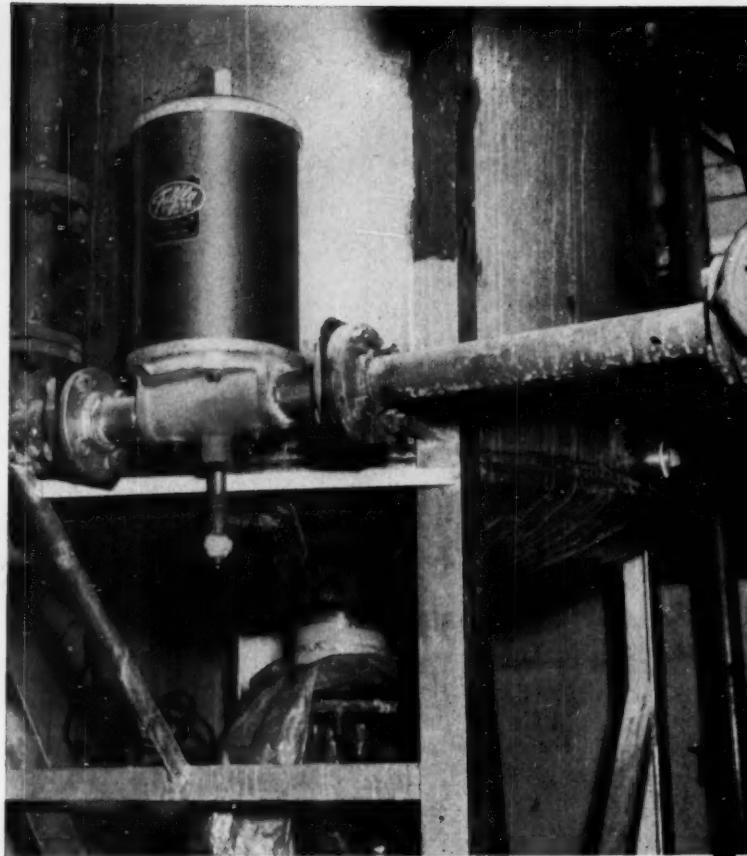
Feed to Storage in Cat Cracker



Effluent Control in Cat Cracker



View of Cat Reformer using Many M-N Valves



**Fulflo  
filters  
help  
assure  
high  
purity of  
NRC  
Tantalum**

WY Fulflo Filter, installed between solution make-up tank and processing tank manifold, removes micro-contaminants from chemical solutions in manufacture of NRC Tantalum.

National Research Corporation of Cambridge, Mass., are specialists in high purity. Their latest achievement — NRC Tantalum — is a triumph of high purity, high corrosion resistance and high melting point that provides new standards of quality for electronics, melting and fabrication.

In the production of high-purity Tantalum, it's only natural that NRC turned to another specialist in high purity — Commercial Filters Corporation. In the specific operation illustrated, Fulflo Filters remove solid contaminants as small as 6 microns in size from sulfuric acid and other solutions used in the production of Tantalum.

Stainless steel containers and Dynel Honeycomb Filter Tubes resist acid solutions. Long-lasting tubes require no maintenance between changes.

Fulflo Filters provide any degree of micro-clarity (down to 1 micron) for all types of petrochemicals, liquid chemicals, pharmaceuticals, oils, liquid fuels, water, compressed air and other gases. They are available in a wide range of models for high or low flow rate, pressure, viscosity, pH or temperature.

*Write for technical literature or engineering assistance to Department CE.*

**COMMERCIAL FILTERS CORPORATION**  
MELROSE 76, MASSACHUSETTS

PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

**MICRO-CLARITY AT MINIMUM COST**



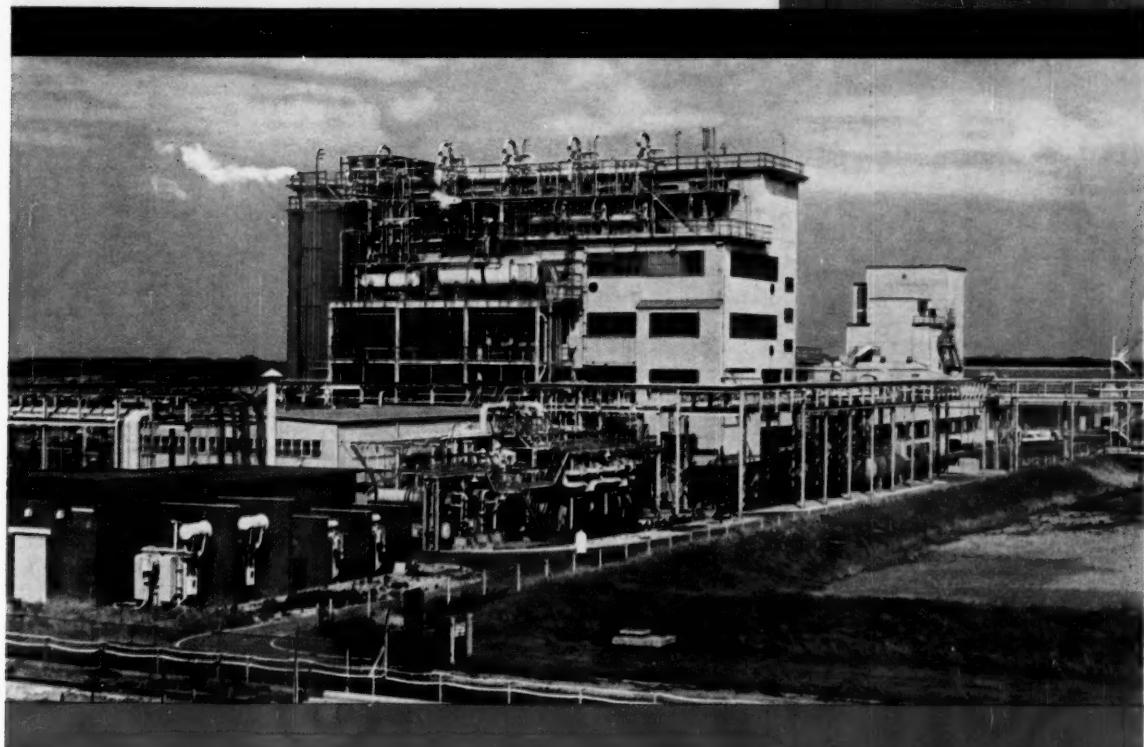
with genuine Honeycomb Filter  
Tubes for controlled micro-  
clarity of industrial fluids.



Selective filtration of oils • water-oil  
separators • magnetic separators •  
pre-coat filters • coolant clarifiers •  
automatic tubular conveyors.

STONE & WEBSTER IN GREAT BRITAIN

## New Flexibility in Chemical Production



Designed for the greatest flexibility consistent with efficient operation, the new Imperial Chemical Industries Limited plant at Wilton, England, currently produces an unusually wide range of copolymers from butadiene and three other monomers. Facilities provide for taking the product as latex, baled crumb or as powder.

The extensive experience of the Stone & Webster organization in design and construction of synthetic rubber facilities during and since World War II was fully utilized in the planning of this versatile British installation. Chemical processes for the new plant were developed by I. C. I., while final designs and actual construction were carried out by Stone & Webster Engineering Limited of London.

Let the skill and experience of Stone & Webster engineers assist you on your next engineering project. Call our nearest office.

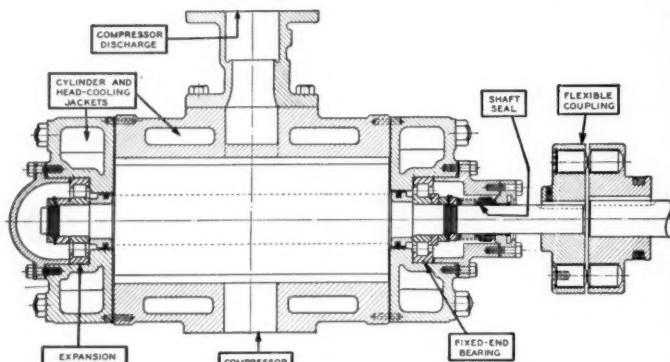
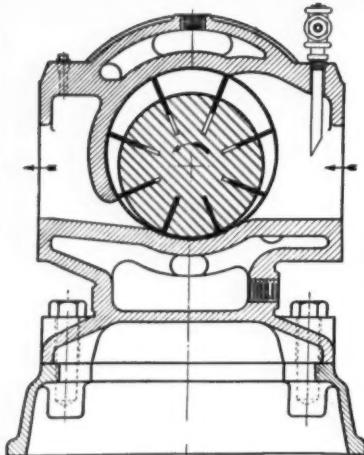
*Stone & Webster  
adds profits to  
your project  
through engineering  
economics and  
plant efficiency.*

## STONE & WEBSTER ENGINEERING CORPORATION

*Affiliated with STONE & WEBSTER ENGINEERING LIMITED (London)*

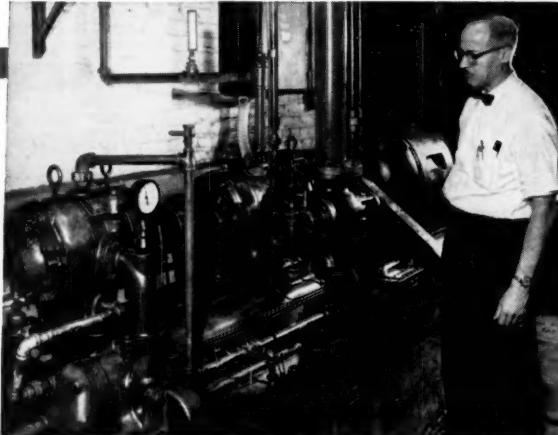
New York Boston Chicago Pittsburgh Houston San Francisco Los Angeles Seattle Toronto





Hard service never affected this Fuller rotary's original output—230 cfm. of air at 90 lb. G., reports Mr. Schott, chief engineer, Thomas C. Wilson, Inc., Long Island City, N.Y.

## FULLER ROTARY COMPRESSOR RUNS 13 YEARS WITHOUT DOWNTIME



A Fuller rotary at Thomas C. Wilson, Inc. got its first maintenance shutdown recently, for renewal of roller bearings and rotor vanes—after running without downtime since 1945.

**4 years of 24-hour service.** The Wilson plant makes tube cleaning equipment, tube expanders and portable pneumatic tools, and so makes heavy daily demands on shop air. For the first four years, three-shift operation kept the Fuller rotary running round the clock. Since 1949, it's been working eight-hour shifts.

**Simple design means trouble-free service.** Besides

bearings, the only moving parts in a Fuller vane-type rotary compressor are the cylindrical rotor and the blades. These compensate for wear automatically. Cylinder head slips off, permitting blade and bearing inspection in a matter of minutes.

**Compact and vibration-free.** Direct-drive system saves space. Simple, rugged design gives constant service without extensive supervision. Thus, Fuller rotaries can be installed out-of-the-way—on upper floor, on balconies, in basement corners, using low-cost, light-weight foundations.

1189  
C-340

Write today for detailed information on the full line of Fuller rotary compressors for in-plant services, gas gathering, and industrial refrigeration.

*For details on the Fuller product line, see Chemical Engineering Catalog.*



**FULLER COMPANY**

**134 Bridge St., Catawba, Pa.**

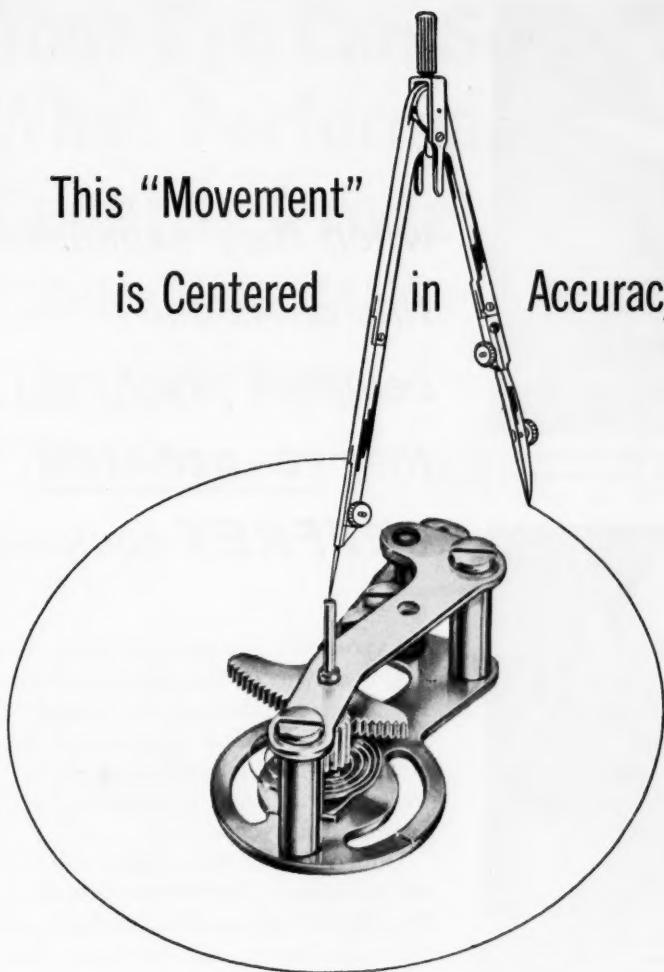
SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION  
Birmingham • Chicago • Kansas City • Los Angeles • New York • San Francisco • Seattle

**Fuller**

*pioneers in harnessing AIR*

**PIONEERS OF HIGH-EFFICIENCY VANE TYPE ROTARY COMPRESSORS SINCE 1930**

This "Movement"  
is Centered in Accuracy



The rotary movement in Ashcroft Duragauges has a geared center shaft on which the pointer is mounted. When pressure flexes the Bourdon tube, the pointer is always positively positioned. You can rely on the Duragauge for precise accuracy in measuring pressure no matter how severe the conditions of service.

Correct calibration is guaranteed: the one-piece link between movement and Bourdon tube prevents slippage or parting under tension. Recalibration is easy from front or rear. Universal adjustability permits uniformly graduated dials.

You can order Ashcroft Duragauges with all-stainless-steel movement or stainless steel with nylon bearings and pinion gear. A complete choice of Bourdon tube materials, pressure ranges, dial sizes and case designs and materials is available. Your industrial supply distributor will gladly help you select the best combination for your requirements. So, be certain of highest sustained accuracy, durability and economy — specify Ashcroft Duragauges.



Ashcroft Duragauge in Alumalife® case—a lifetime case made of special aluminum alloy.

## ASHCROFT PRESSURE GAUGES

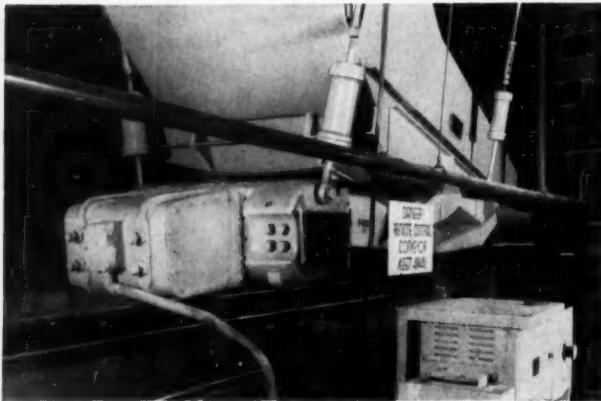
*A product of*  
**MANNING, MAXWELL & MOORE, INC.**



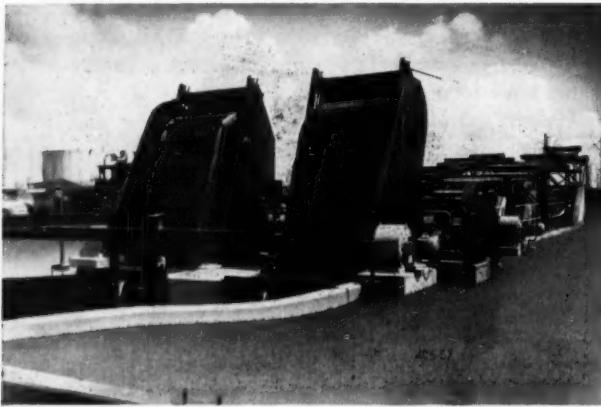
Consolidated Ashcroft Hancock Division • Stratford, Connecticut  
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario



Jeffrey belt conveyors transport wood chips to storage towers . . . move material to giant digesters as needed for production of chemical cellulose at Rayonier's Jesup plant.



Jeffrey vibrating feeders automatically control flow of materials in a wide range of processing operations. Here, wood chips are metered from a remote-control location.



Jeffrey bark and grit removal equipment for clarification of processed water.

*when they expanded  
this chemical  
cellulose plant,  
they **re-ordered***  
**JEFFREY equipment**

RAYONIER's new plant at Jesup, Georgia, is a twin to the plant built there in 1954. Each has the capacity to produce over 300 tons of chemical cellulose per day. The remarkably low-cost production facilities were designed and constructed by Ebasco Services Incorporated.

Duplication of the original mill indicates the satisfactory performance realized with the original equipment . . . including Jeffrey vibrating feeders, belt conveyors, bark and grit removal equipment.

Planning to expand your production? It will pay you to call in Jeffrey. For information on Jeffrey equipment for your requirements write The Jeffrey Manufacturing Co., 909 North Fourth Street, Columbus 16, Ohio.



**JEFFREY**

CONVEYING • PROCESSING • MINING EQUIPMENT . . . TRANSMISSION MACHINERY . . . CONTRACT MANUFACTURING

# Your Eye Can See What Performance Records Prove **LUNKENHEIMER** **LUNCOR® PVC** **CUTS MAINTENANCE**

Before Luncor, corrosive service required expensive high-alloy installations. Now, the very ruggedness and dependability you see in the unre-touched photo, below, has been put to work in hundreds of corrosive applications to bring about low initial costs, lower maintenance costs.

Luncor is the first PVC valve designed and engineered by a valve manufacturer. Its maintenance-free performance has been proved in corrosive services in:

- PAPER MILLS
- PETROLEUM REFINING
- CHEMICAL PLANTS
- SUGAR REFINING
- FOOD PROCESSING
- WATER TREATMENT
- BEVERAGE BOTTLING
- MARINE INSTALLATIONS

Let your Lunkener Distributor show you the money-saving, high-performance benefits of Luncor PVC Valves. For service recommendations, ask him for a Confidential Corrosion Service Form. Or write: The Lunkener Company, Cincinnati 14, Ohio.

Fig. 2600 Screwed End  
Fig. 2601 Socket End

125 lb. W. O. G. 140°F.  
Sizes  $\frac{1}{2}$  to 2-inch



**LUNKENHEIMER®**  
THE ONE *Great* NAME IN VALVES



## Do you have a **DUST PROBLEM?**



### **AAF TYPE N ROTO-CLONE DOES MANY JOBS FOR CHEMICAL PROCESSORS**

If your operations require collection of heavy dust loadings of all particle sizes, you've got a job for the AAF Type N ROTO-CLONE. The engineered simplicity of this hydrostatic precipitator assures highest efficiency and lowest maintenance costs.

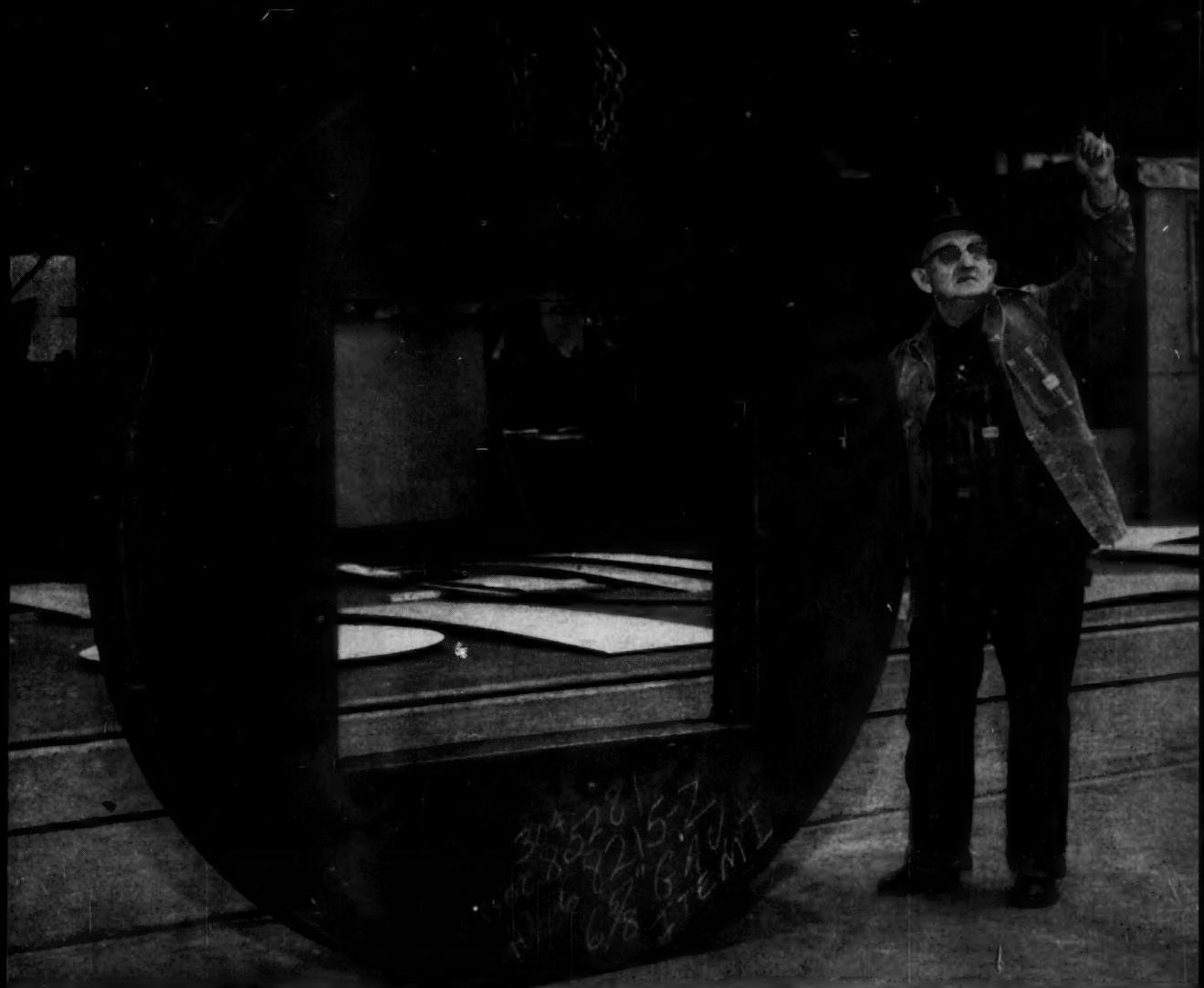
The rugged Type N achieves its high efficiency from the combined action of centrifugal force and

thorough intermixing of water and dust-laden air. Compact design makes for important space savings.

For complete information on this versatile wet collector, call your local AAF representative or write direct for Bulletin 277. Address Mr. Robert Moore, American Air Filter Company, Inc., 326 Central Avenue, Louisville 8, Kentucky.



**American Air Filter**  
BETTER AIR IS OUR BUSINESS



Type 304 stainless plate, dimensions: 6  $\frac{1}{2}$ " thick x 75" diameter. Weight, 8655 lbs.

# take a look

**... at the clean edges of this stainless plate**

**accurately cut by Carlson**

THIS stainless plate illustrates something that's almost a Carlson exclusive. Few producers can make plates of such heavy gauge, and fewer still have the long experience in flame cutting stainless to precise dimensions. To develop the proper equipment, the exact gas and iron powder formula, and the special nozzles, took Carlson engineers years of effort. But the result was worth it.

The edges achieved by these improvements reduce the cost of subsequent machining operations. And every Carlson stainless plate—whether heavy or light gauge—carries its own identification. Its chemical and physical properties are known and recorded. Its dependable performance on the job is assured.

The complete reliability of every Carlson service will materially reduce your ultimate costs. Our specialists make certain that your instructions are followed in every detail. Write, wire or phone for further information on all our services in stainless steel.

**G.O.CARLSON Inc.**  
*Stainless Steels Exclusively*

134 Marshalton Road  
THORNDALE, PENNSYLVANIA  
District Sales Offices in Principal Cities



PLATES • PLATE PRODUCTS • HEADS • RINGS • CIRCLES • FLANGES • FORGINGS • BARS AND SHEETS (No. 1 Finish)



## **Who cares about your Wire Cloth Fabrications?**

**CAMBRIDGE** does . . .

that's why you automatically get service with your order . . . whether you need dozens of midget strainers or a single giant-sized retaining screen.

Careful, competent workmanship and constant inspection assure you of quality . . . modern machinery and accurate scheduling assure you of prompt delivery. And, a Cambridge Field Engineer follows up your order to make sure our product is giving you the best possible service. Let us quote on your next order for wire cloth fabrications. We manufacture wire cloth from any metal or alloy—including titanium—in nine basic weaves. We'll work from your prints or draw up prints for your approval. Call your Cambridge Field Engineer . . . he's listed in the yellow pages under "Wire Cloth". Or, write for FREE 94-PAGE CATALOG.

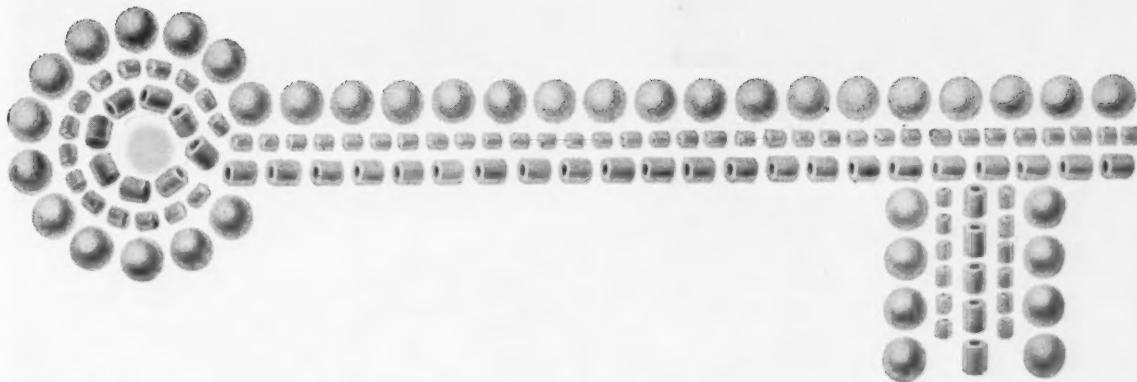
### **The Cambridge Wire Cloth Co.**

Department G • Cambridge 4, Md.



Manufacturers of Wire Cloth,  
Metal-Mesh Conveyor Belts, Wire Cloth Fabrications





## Keys to better catalysis

... *NORTON Ceramic Catalyst Carriers*

In modern chemical and petrochemical process reactions, very often the choice of proper catalyst carriers is as critical a factor as selection of the catalysts themselves. And time and again, NORTON Ceramic Catalyst Carriers have proved the *best* choice both for efficiency and economy.

It's more than just a question of a quality product. There's a personal equation involved — the Norton Man. He brings to chemical engineers the benefits of NORTON COMPANY's years of experience in the chemical and petrochemical fields as well as the end products of its advanced manufacturing and quality control methods. He *understands* the problems involved. And, backed by NORTON COMPANY's extensive research and engineering facilities, he's well qualified to help in their solution.

Whatever the feedstock or thermal

conditions involved . . . whether reaction is in the gaseous or liquid phase . . . whether the carrier is to be coated or impregnated with the active agent, he's ready to suggest the specific NORTON product that will do the job best. He also knows that *every* NORTON Carrier gives chemical processors the assurance of highest uniformity. From lot to lot — in any quantity — size, weight, porosity, pore diameter and purity are held to close tolerances that assure precise duplication of results.

Take advantage of the service the Norton Man represents. Let him help you to meet catalyst carrier specifications exactly. It's the simple practical way to insure maximum catalyst activity and life . . . to keep catalyst costs low . . . to get optimum yield from your process. Write NORTON COMPANY, Refractories Division, 503 New Bond Street, Worcester 6, Mass.

### WIDE RANGE OF TYPES AS FOLLOWS

Shapes	Materials
Spheres	Alumina
Rings	Silicon Carbide
Pellets	Fused Magnesia
Granules	Zirconia
Powders	Silica, Zircon
	Magnesia — alumina
	Spinel, etc.

**Porosity** — from 10% to 50%

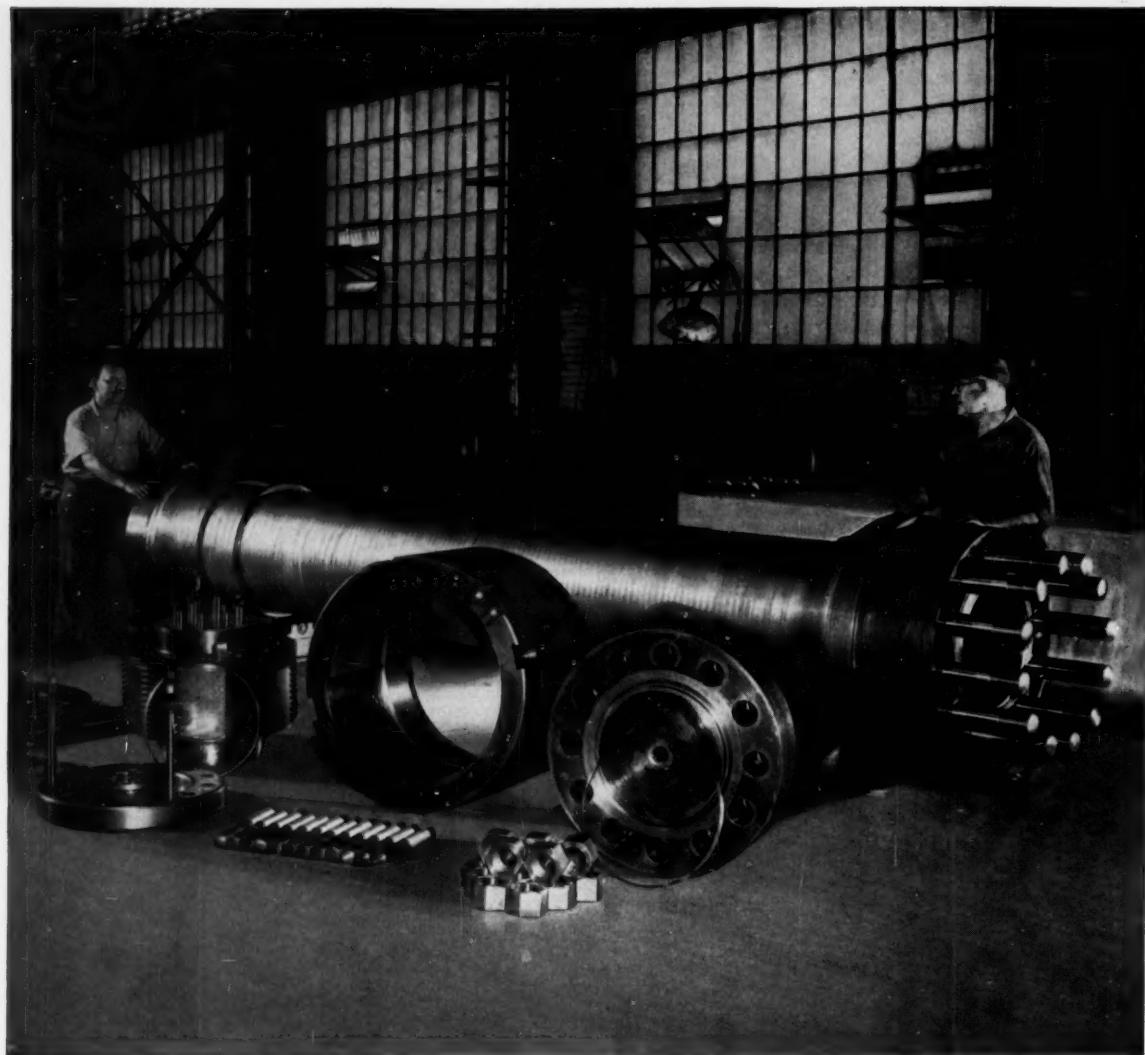
**Surface Area** — from less than 1 to 70 m<sup>2</sup>/gram\*

\*BET Method

**NORTON**  
REFRACTORIES

Engineered... Rx...Prescribed

**Making better products . . . to make your products better**  
NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — BEHR-MANNING DIVISION Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes



## Closely Machined to Contain High Pressures

As pressure vessels go, this is a relatively small one—just 14½ tons fully assembled. But it contains literally scores of parts, some of which required elaborate machining.

After we had made the steel and done the necessary forging and treating, our machinists took over. Most of the tolerances were small, yet every specification was met in full. Under hydrostatic test, the vessel "proved out" perfectly.

At Bethlehem, machining is done as carefully—and capably—as the vital preliminary steps.

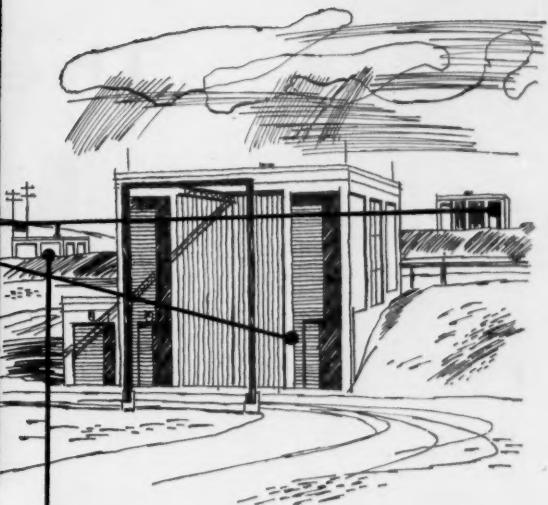
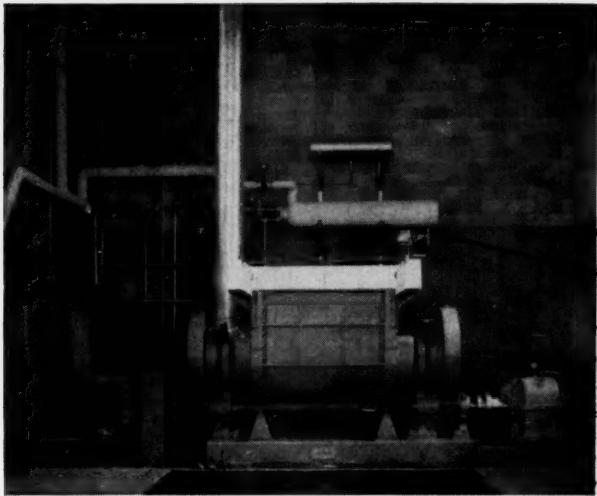
Thus a completed Bethlehem vessel always has the snug, tight-fitting parts so essential in pressure work. Call us when in the market for fully machined converters, reactors, separators, filters, autoclaves, accumulators. We build them in a complete range of sizes up to 150 tons or more.

**BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.**

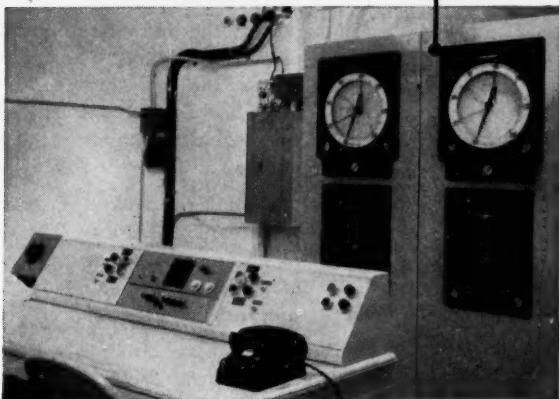
*On the Pacific Coast Bethlehem products are sold by  
Bethlehem Pacific Coast Steel Corporation.  
Export Distributor: Bethlehem Steel Export Corporation*

# BETHLEHEM STEEL





**TWO MORE BAKER PERKINS  
MIXERS ON THE JOB at new  
*Thiokol*<sup>®</sup> solid propellant plant in Utah**



Inorganic oxidizers, the chemicals which make solid rocket propellants burn with such intensity, are first ground to a particle size . . . blended thoroughly . . . then mixed with an elastomeric binder. Fundamentally, that's how Thiokol Chemical Corporation makes a fuel for a rocket motor. The mixing of high energy fuels is a delicate, exacting operation and the mixers must be highly efficient and absolutely dependable.

At the Brigham City, Utah plant, Thiokol has recently installed two more Size 18 JWRM-2 Baker Perkins mixers. Each of these mixers is constructed of stainless steel and has a 300 gallon working capacity. The units, housed in specially constructed buildings, are remote controlled from another building.

Because they are safe and efficient, more and more B-P mixers are being used by the rapidly expanding propellant industry. These same high standards of quality are also incorporated into the standard design mixers built for the chemical process industry.

Whatever your requirements may be, Baker Perkins builds mixing machinery to handle every job. Why not write today for Bulletin No. CE-58 containing information on B-P equipment for the chemical process industries.



See our insert in Chemical  
Engineering Catalog.

**BAKER PERKINS INC.**

CHEMICAL MACHINERY DIVISION • SAGINAW, MICHIGAN

CHEMICAL ENGINEERING—April 6, 1959

365

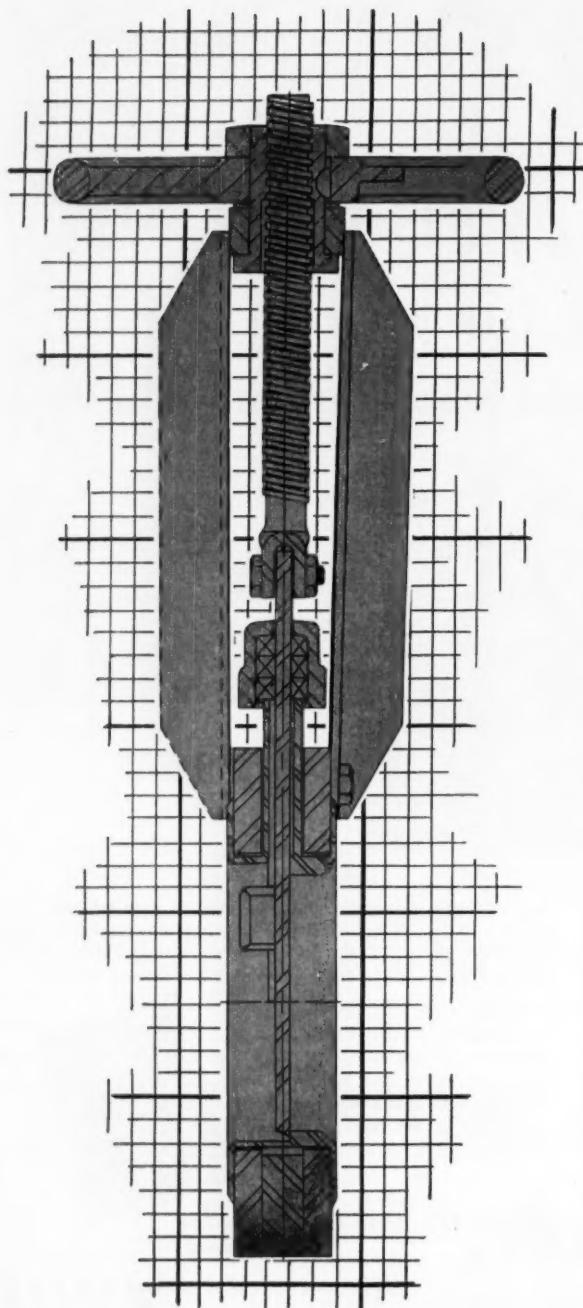
The

**LOW**

**COST**

**of**

**Valving...**



The processing of corrosive chemicals — the handling of acid or alkaline services—has always required expensive valves . . . until now!

But now . . . ! DeZurik Fabricated Knife Gate Valves have *high* resistance to corrosion at a low, low cost.

Only the parts coming in contact with the flow utilize high alloys. The remaining structural portions of the valve are produced in mild steel or in other economical metals. (Fabricating out of plate material also eliminates the porosity of cast metal valves.)

Their light weight drastically reduces installation costs and their bonnetless design all but eliminates maintenance expense. Yet their rugged construction withstands piping strains and line pressure.

They're available in a wide range of metal combinations and in several different styles. A full complement of operators is also available.

For more information, see the DeZurik representative in your area . . . or write for Bulletin 300.



**DeZURIK**  
**CORPORATION**  
SARTELL, MINNESOTA



## *Profitable Brands Start With Cherry-Burrell*

Lady Esther Cosmetic Cream must be as smooth and even as the ladies' skin it cares for. Profitable repeat sales of this popular beauty aid depend on reliable, consistent texture.

Cherry-Burrell Superhomo Homogenizers keep Lady Esther Cream smooth and creamy. C-B's high speed shearing action cuts fat globules down to equal size. Steady pumping pressure disperses them thoroughly through the cream. Eliminates any chance of oil separation, any return to the prehomogenized

state. Lady Esther never disappoints its millions of lovely customers.

**In-plant profit, too.** Cherry-Burrell helps produce the product profitably. Superhomo valve caps absorb 98% of valve wear. Saves on plug and seat regrinding. And Stellite valve seating surfaces reduce maintenance as much as 80%.

Another profitable producer is Cherry-Burrell's Round Processor. It can be used for heating, pasteurizing, cooking, mixing, blending, cooling, holding,

setting, refrigerated storing and air unloading, all with efficient flexibility.

A Cherry-Burrell Sales Engineer will be glad to show you how Cherry-Burrell equipment can profit you. There's no obligation. Call or write him today.

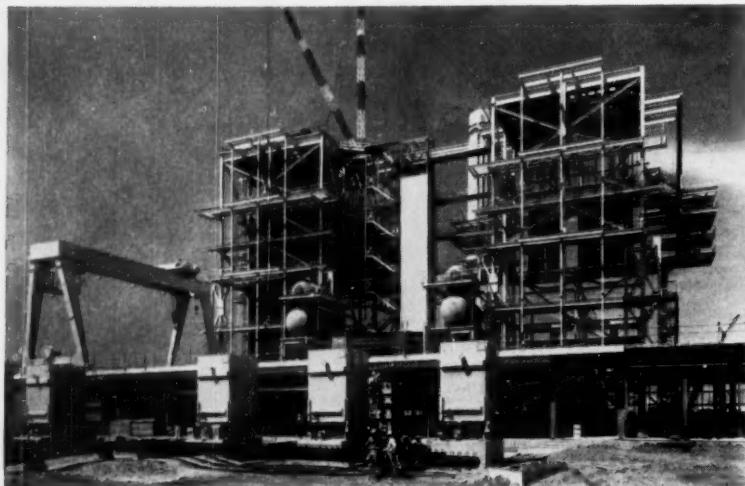
**CHERRY-BURRELL**  
CORPORATION  
CEDAR RAPIDS, IOWA  
Chemical • Dairy • Food • Farm • Beverage  
Brewing • Equipment and Supplies

# FRESH WATER NEWS

from Cleaver-Brooks Special Products, Inc.

CAPSULE REPORTS AND INFORMATION ON THE  
PRODUCTION OF FRESH WATER FROM THE SEA

## Pilot plant in California may open new era in salt-to-fresh water conversion



### NEW CONSTANT CAPACITY EVAPORATOR CAPTURES WASTE DIESEL HEAT TO SUPPLY FRESH WATER FOR OFF-SHORE RIGS

A new high-capacity waste heat evaporator for off-shore drilling rigs and tenders has been developed by Cleaver-Brooks Special Products, Inc.

Operating from waste heat of generator-driving diesels, the new flash type unit manufactures fresh water from sea water at constant output. And output is independent of drilling operations.

Costs are kept low due to conservation of fuel and unusually low main-

tenance requirements.

The heat required for evaporation is derived from the diesel engine cooling water. The flashing principle utilized by the new unit eliminates scaling problems common with conventional evaporators. Maintenance usually involves only simple brush-out after prolonged periods of operation.

As installed, the unit can provide pure water for drinking, drilling, makeup, bathing and cooking.

### ENGINEERS EXPLAIN HOW NEW METHODS, MATERIALS CUT COSTS, REDUCE UNIT SIZE

According to Cleaver-Brooks engineers, savings of 30% on unit volume and 20% on unit costs are possible through new design and construction of the company's evaporation and distillation equipment.

For example, the deck space needed for a 12,000 gpd flash

evaporator has been reduced from 70 sq. ft. to 55 sq. ft., height cut by 12%.

On the cost side, improved design using equally reliable but lower-cost materials and improved manufacturing techniques — resulted in cost cuts of 20% on one model.

Today, Cleaver-Brooks flash evaporators get one-eighth grain of sea salts per gallon of sea water rather than the usual residue of one-fourth grain per gallon — a 50% improvement in effectiveness.



In a contract recently awarded to Cleaver-Brooks Special Products, Inc., the Southern California Edison Company embarked on a far-reaching program for conversion of sea water to fresh water. The contract calls for construction of a sea water distillation plant with a capacity of about 100,000 gallons a day. It will be operated in conjunction with existing steam generating facilities at the Mandalay Steam Station near Oxnard, Calif. The operation will be the first of its kind in the country.

Awarding the contract, Southern California Edison revealed that Cleaver-Brooks Special Products had made its bid on an evaporator based on a new principle which greatly reduces required heat transfer surface and pumping power. The new unit can be used for both distillation through use of residual heat in cooling water and for distillation using steam extracted from the turbine.

Success of the pilot plant will signal a significant step forward toward the tapping of ocean water for use in home, industry and agriculture. However, Edison officials caution that at this time the water produced by the pilot plant is not expected to compete in cost with fresh water from natural present sources. The hope is that similar installations will eventually be advantageous to use in areas where current water costs are high.

Upon completion of construction, Cleaver-Brooks engineers, who worked with Edison in designing the job, will continue to cooperate in its operation.

**Cleaver-Brooks  
Special Products, Inc.**

225 Grand Avenue, Waukesha, Wis.

# Which of these 3 products and services can you use?

## New Cold Caustic Bleach Process

Looking for a way to use greater amounts of low-cost, more plentiful pulp—without capital investment for bleach equipment? Then let a Becco Sales Engineer show you our new technique\* which allows you to bleach in the same equipment regularly used for the manufacture of cold caustic pulp.

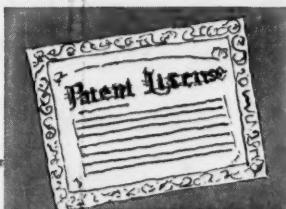
In this new process, peroxide bleach liquor is added at the Bauer Refiner, and bleaching occurs during the refining operation. Bleach response depends on refiner densities.

Up to 20 points brightness increase has been obtained in commercial operations to date, and with no additional steam costs, no holding time, and no excessive chemical costs.

Becco can assist you immediately in setting up a production run and evaluating results.

First step: use the coupon to let us know you're interested.

\*—Patent Pending



## "Enclosing \$100— Send Patent License"

Well, perhaps there's a little more to your gaining use of Becco patents than just mailing your dollar in, but not much more. And certainly, no more money. The \$1.00 really does cover it.

Becco has lots of patents, granted as a result of innovations in the use of Hydrogen Peroxide and other Peroxygen chemicals developed in Becco's Research Laboratories. But they don't do us a whole lot of good locked tightly in our safe. So, we long ago adopted the following policy:

If one of our patents can help you, we'll be glad to license the rights to you *perpetually*, for just one dollar. You get a nice certificate, incidentally, to cover the legalities, but more important—you also get free our complete engineering help in setting up your process, handling the material, maintenance, etc., etc.

What do we get? You as a customer—we hope—but there's no obligation on your part. Just seems to work out that way, though—when we know enough about a particular peroxygen to hold a patent on its use, chances are we've also learned enough to produce it purer than anyone else. You benefit from this; we do, too.

Use the coupon below to ask for a Sales Engineer—or our list of patents—that may help you solve an important problem.

## Problems in handling Hydrogen Peroxide



Becco's Four-Fold Engineering Service Program—offered free—includes:

1. Comprehensive survey of your facilities.
2. Specific proposal with recommendation of proved equipment and where it is obtainable.
3. Installation supervision by Becco.
4. Periodic inspection and permanent service.

Can you use this free Becco help, based on more years of experience with bulk handling of  $H_2O_2$  than any other manufacturer? Use the coupon to let us know.

# BECCO



BECCO CHEMICAL DIVISION, FMC  
Station B, Buffalo, New York

Dept. CE-H

Gentlemen:  
Please have a Sales Engineer give me more information on Becco's Cold Caustic Bleach Process.

NAME \_\_\_\_\_

FIRM \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

ZONE \_\_\_\_\_ STATE \_\_\_\_\_

# BECCO



BECCO CHEMICAL DIVISION, FMC  
Station B, Buffalo, New York

Dept. CE-F

Gentlemen:  
Please send your list of patents available on the use of

- Hydrogen Peroxide
- Peroxygen Chemicals
- Persulfate Chemicals
- Please have a Sales Engineer call.

NAME \_\_\_\_\_

FIRM \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

ZONE \_\_\_\_\_ STATE \_\_\_\_\_

# BECCO



BECCO CHEMICAL DIVISION, FMC  
Station B, Buffalo, New York

Dept. CE-B

Gentlemen:  
Please tell me more about your Four-Fold Engineering Service.

NAME \_\_\_\_\_

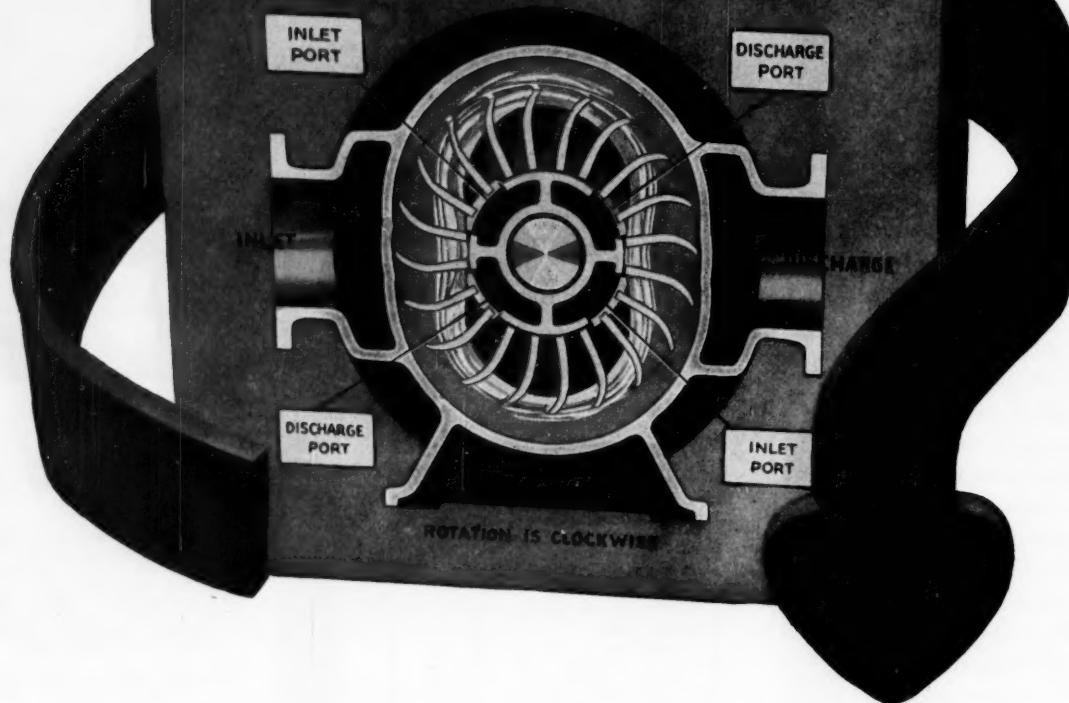
FIRM \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

ZONE \_\_\_\_\_ STATE \_\_\_\_\_

**Nash Instrument Air Compressors  
deliver only clean air, free from  
oil or dust, and without filters.**



## *Here is Why!*

You can dispense with oil filters and dust filters when you install <sup>®</sup>Nash <sup>®</sup>Clean Air Compressors. You can save the cost of maintaining these devices. You can greatly reduce instrument maintenance costs. For the Nash employs no internal lubrication, therefore no troublesome oil is in the delivered air. Moreover, air from a Nash is thoroughly washed and cooled as it passes thru the pump. Dust in the plant atmosphere, even fly ash, is immediately removed.

<sup>®</sup>Nash <sup>®</sup>Clean Air Compressors are simple, with only one moving element. No valves, gears, pistons, sliding vanes, or other enemies of long life and constant performance complicate a Nash. No aftercoolers are needed. You will find it profitable to investigate these pumps, now.

- No oil filters.
- No dust filters.
- No internal lubrication to contaminate air handled.
- No internal wearing parts.
- No valves, pistons, or vanes.
- Non-pulsating pressure.
- Original performance constant over a long pump life.
- Low maintenance cost.

**NASH ENGINEERING COMPANY  
395 WILSON, SO. NORWALK, CONN.**

# EMERY Engineered WEIGHING SYSTEM NEWS

## HYDRAULIC CELLS "NATURALLY" DAMPEN OUT OSCILLATIONS OF VIBRATORY LOADS

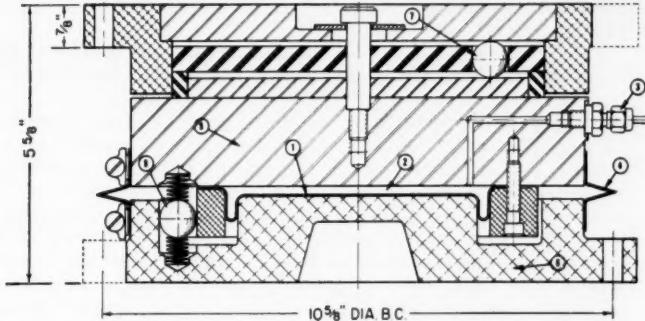
Precision weighing of a vibratory load poses a troublesome problem for the instrument man. This is particularly true if the oscillations of the vibrations are irregular in both magnitude and time.

Where effort is made to use electrical load cells to do this job, filters are employed. In many instances, the drift of the filter is greater than the desired measurement.

Engineering-wise it is a well-known fact that oil has within itself the natural property of dampening out vibrations. This, plus the proper engineering of tubing and valves, make the Emery Engineered Weighing System the most effective method available today for solving the problem of dampening out troublesome vibrations to give precision weighing of vibratory loads.

When writing, refer to Item 1009

## WAY-PAC HYDRAULIC CELL LINE IS NOW EXPANDED TO 5,000 LB. CAPACITY



Cross section of the new 5,000 lb. capacity WAY-PAC Compression Cell with the exclusive Emery "rolling ball head" (Type AC-5-RB).

The recently-introduced line of Emery WAY-PAC Hydraulic Load Cells has now been expanded to include capacities of 5,000 lbs. The original WAY-PAC line was limited in its rating up to 1,000 lbs.

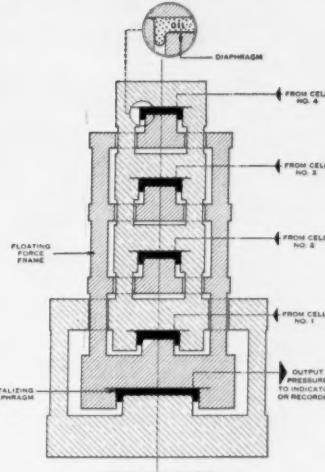
The WAY-PAC 5,000 lb. cells are similar to the previous 1,000 lb. cells in manufacture but the new dimensions

## WAY-PAC LOAD TOTALIZER UNIT COMBINES HYDRAULIC CELL LOADS

The new, simple, self-contained Emery WAY-PAC Load Totalizer Unit, a device for combining the loads on two, three, or four WAY-PAC Cells, has a sensitivity of 1 part in 5,000 and will accept the maximum capacities of both the 1,000 lb. and the 5,000 lb. cells. It is shock resistant, weather-proof, and is not affected by temperature variations.

Measuring 9 1/2" in overall height, the totalizer contains diaphragms each of which exerts a load on a floating force frame. The force frame, in turn, exerts this total load on the totalizing diaphragm where it is again converted into a combined output hydraulic pressure which represents the combined load on two, three, or four WAY-PAC cells. All types of indicating, recording and controlling instrumentation may be used in conjunction with the WAY-PAC Load Totalizer.

When writing, refer to Item 1006



The new WAY-PAC Load Totalizer combines the loads on two, three or four WAY-PAC Load Cells.

## NEW 19 1/2" DIAL INDICATOR WILL IMPROVE ACCURACY OF CELL PRESSURE READINGS

Taking pressure readings with increased accuracy is much easier with the new Emery 19 1/2" dial indicator. Previously, the largest dial offered measured 16 1/2" in diameter.

Since the basic objective of dial reading is accuracy, our 19 1/2" indicator makes possible greater accuracy than ever before. Because of the larger scale length, graduations can be better matched to the job. Easy and accurate readings are a basic advantage with the new Emery 19 1/2" indicator.

When writing, refer to Item 1007

The A. H. Emery Co., New Canaan, Conn.

I am interested in the following:

Item 1006  Item 1008   
Item 1007  Item 1009

Seeing Representative

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

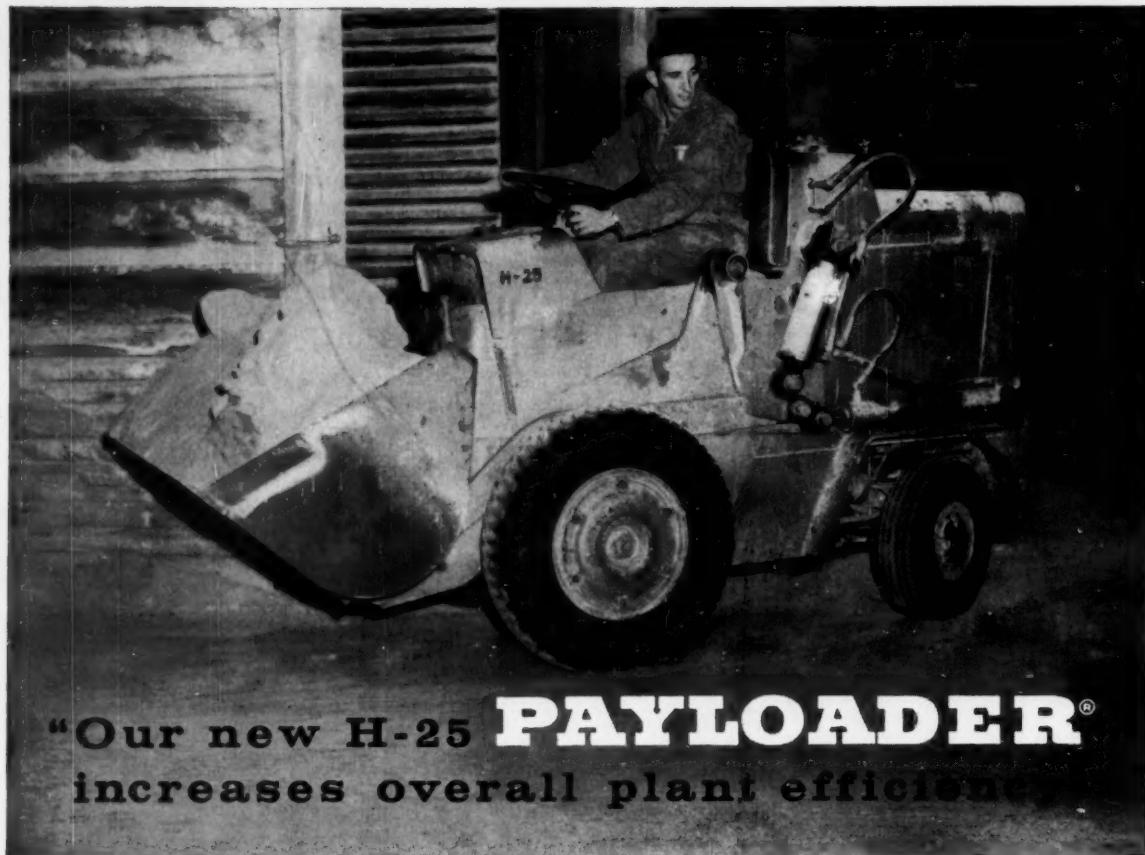
City \_\_\_\_\_ State \_\_\_\_\_



THE A. H. EMERY COMPANY  
New Canaan, Conn.

Engineered WEIGHING SYSTEMS





## "Our new H-25 **PAYLOADER**<sup>®</sup> increases overall plant efficiency."

\*  
That's how Ralph J. Puetz, Plant Supt. of Senesac Fertilizer, Inc., Fowler, Indiana sums up the benefits of the H-25's "larger bucket capacity, power-shift transmission and other operating features". At the same time, he also adds a good word for their 4-year old model HA which "has worked continuously, giving very good service with no repairs except normal maintenance".

If you want to get more production per tractor-shovel and per operator, the Model H-25 "PAYLOADER" merits your consideration.

**BUILT FOR PRODUCTION** — On several occasions Senesac's Model H-25 has unloaded 50-ton rail cars of bulk material in one hour. With its 2,500 lb. carry capacity — 25 to 50% more than has been heretofore available in a 6-foot-turning radius unit — the H-25 can carry more per trip. Because of its power-steer and power-shift transmission with 2 speed ranges forward and reverse, it handles with finger-tip ease and cycles faster to make more trips. The more-powerful bucket break-out action, and more-positive traction provided by power-transfer differential get big loads easier out of hardened stockpiles.

**BUILT-IN PROTECTION** — It has extraordinary protection against dust and dirt damage: triple air cleaners — precleaner and two oil-bath air cleaners; cartridge-type oil filters on the three oil systems; sealed self-adjusting hydraulic service brakes; parking brake enclosed in transmission; special oil and grease seals on all vital points.

For bigger loads, for faster, easier operation — for more production per shift at lower net cost per ton, get an H-25 demonstration from your Hough Distributor. Ask him about Hough Purchase and Lease Plans, too.

**THE FRANK G. HOUGH CO.**

754 Sunnyside Ave., Libertyville, Ill.

Send data on new H-25 "PAYLOADER"  
 On Other "PAYLOADER" models

Name.....

Title.....

Company.....

Street.....

City..... State.....

4-4-1

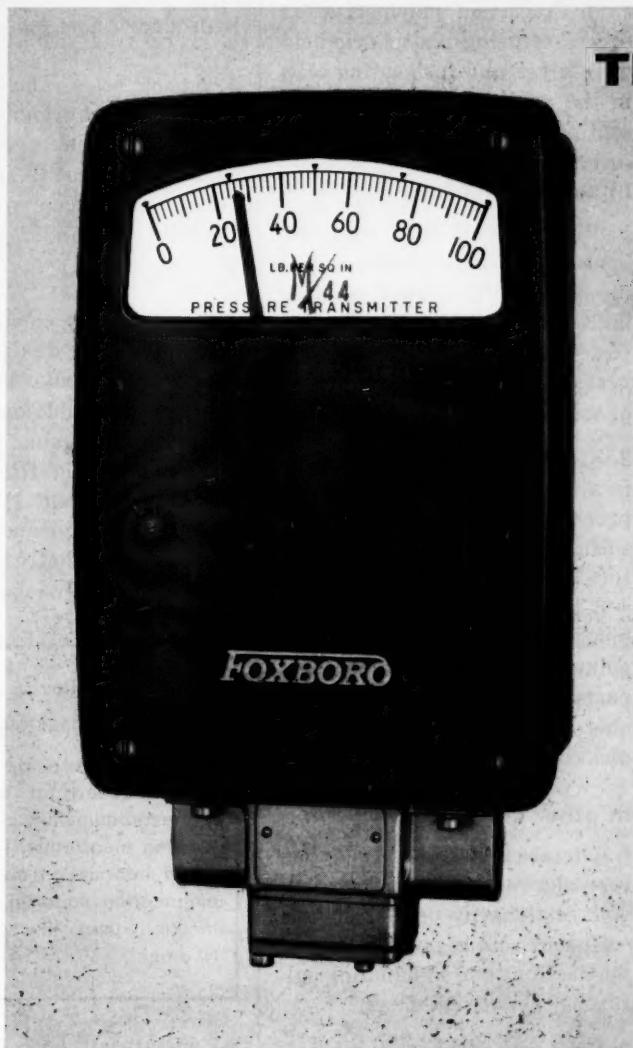
# HOUGH<sup>®</sup>

**THE FRANK G. HOUGH CO.**  
LIBERTYVILLE, ILLINOIS  
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY 

...  
 read pressure up to 20 ft. away!



**on the FOXBORO  
M/44 INDICATING  
PRESSURE  
TRANSMITTER**



You can check pressure readings at a glance on the Foxboro Pneumatic Indicating Pressure Transmitter. Its open-face, horizontal, 4-inch indicator scale and eye-catching red pointer are clearly visible as far away as 20 feet.

But high readability is just part of the story. Actually, this instrument was engineered from the ground up. Makeshift arrangements have been eliminated, hung-on gauges are gone. Everything is included in one compact (5 $\frac{3}{4}$ " x 8 $\frac{1}{8}$ "), ready-to-install instrument that weighs only eight pounds.

Because the indicating pointer is direct-connected to element and transmitter, calibration is easy... and you can re-zero the transmitter externally. All M/44 components are standard, performance-proved Foxboro parts. This makes it easier to stock and service.

A wide selection of interchangeable Foxboro pressure measuring elements gives the M/44 range limits of 0-30" water to 0-6000 psi. Elevated ranges are available, too.

Write for complete details. The Foxboro Company, 364 Neponset Ave., Foxboro, Mass.

**FOXBORO**  
REG. U.S. PAT. OFF. **INSTRUMENTATION FOR INDUSTRY**

# IT'S NEWS! IT'S NI-O-NEL!

## ...a field-proven Inco Nickel Alloy for handling certain hot acids and oxidizing chemicals

Inco is now making available a field-proven alloy to handle corrosive conditions of unusual severity.

The alloy, called Ni-o-nel\*, is made of Nickel (42%), chromium (21.5%), and iron (30%) with additions of molybdenum and copper. It is highly resistant to hot sulfuric, sulfurous and phosphoric acid conditions and to oxidizing conditions such as nitric acid solutions, nitrates and cupric, ferric and mercuric salts, except the chlorides.

Ni-o-nel alloy is stabilized by the addition of titanium and by its moderately low carbon content to prevent attack due to carbide precipitation.

### In phosphoric acid:

1. Ni-o-nel alloy submerged cylinders and baffle plates in submerged combustion evaporators concentrating wet process phosphoric acid at temperatures up to 280°F, are giving 3 to 5 times the service life of previously-used materials.

2. In the dip pipes of units concentrating phosphoric acid by passing preheated air into the acid, Ni-o-nel alloy outlasted the previous alloy by 11 to 7.

3. In a defluorinating unit handling phosphoric acid of 54%  $P_2O_5$  content, Ni-o-nel alloy

lasted 2 to 6 times longer than the best previously-used alloy.

4. Ni-o-nel alloy can also be used in many similar applications such as hydrocarbon polymerization processes using phosphoric acid as catalyst, and for heating coils in the application of phosphate coatings to steel.

### In sulfuric acid:

1. Platecoils of Ni-o-nel alloy have been used for heating a 12% (by wt.) sulfuric acid pickling bath maintained at 170°F. The platecoils lasted approximately 3 years (6 times longer than those of another resistant alloy).

2. Ni-o-nel alloy dancer roll arms in a continuous pickler used for processing steel strip in 8-12% sulfuric acid at 130°F temperature have so far lasted 17 months — 3 times longer than the previously-used alloy, and are still going strong. The Ni-o-nel alloy parts are subjected to considerable aeration as well as to the pickling solution itself.

### In other corrosives:

1. **Sulfurous acid.** Ni-o-nel alloy has been shown to be superior to alloys customarily used to handle sulfurous acid in pulp and paper applications and in handling sulfurous combustion gases.

2. **Nitric acid mixtures.** Ni-o-nel alloy is resistant to nitric acid solu-

tions of practically all temperatures and concentrations and shows good promise for handling such mixtures as nitric-sulfuric, nitric-phosphoric and some nitric-hydrofluoric acid solutions.

**3. Organic acids.** The alloy is resistant to most organic acids and has excellent resistance to boiling concentrated acetic acid, acetic-formic mixtures, maleic and phthalic acid and a number of others.

**4. Sea water and chlorides.** This alloy not only resists a wide range of chemical corrosives but also certain troublesome salt cooling waters, making it particularly adaptable for heat exchanger equipment. It resists pitting in salt water and has excellent resistance to stress-corrosion cracking.

\*Registered trademark

### Ni-o-nel alloy is a fully developed engineering material

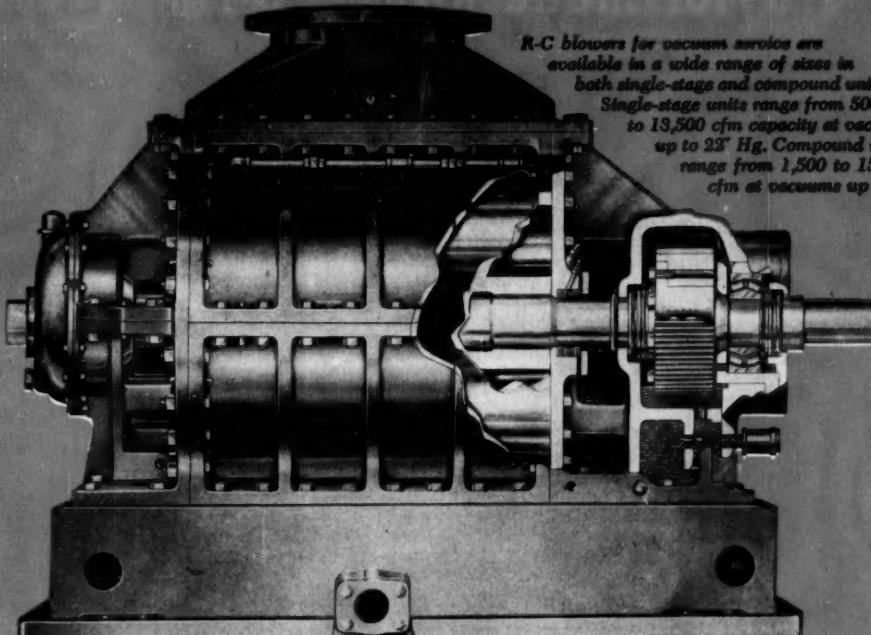
Ni-o-nel alloy is made in all mill forms needed for fabricating process equipment...including welding electrodes. To get detailed information on this new engineering material, write for Inco's booklet, "Introduction to Ni-o-nel."

The INTERNATIONAL NICKEL COMPANY, Inc.  
67 Wall Street  New York 5, N.Y.

## INCO NICKEL ALLOYS

# POWER SAVINGS

R-C blowers for vacuum service are available in a wide range of sizes in both single-stage and compound units. Single-stage units range from 500 to 13,500 cfm capacity at vacuums up to 22" Hg. Compound units range from 1,500 to 15,000 cfm at vacuums up to 27" Hg.



## ...up to 25% with R-C Cycloidal Blowers for Vacuum Service

Because R-C cycloidal blowers for vacuum service operate at higher speeds with reduced horsepower, power savings of as much as 25% are often possible. Their simple design and rugged construction assure superior performance, low maintenance and long life. These advantages derive from the high volumetric efficiency of the design, low mechanical friction and installation flexibility. Minimum sealing water effectively overcomes slippage loss . . . as little as 4 gpm may be required.

R-C blowers for vacuum service are used throughout the world in a large number of industries. In chemical processing, R-C blowers have many applications in the handling of nitrogen, hydrogen, acetylene, moist air with  $\text{SO}_2$ , and other oil and gas mixtures. In paper-making, R-C blowers supply vacuum for suction rolls. In mining, R-C blowers provide vacuum for flotation, filtration and other ore processing requirements. And throughout general industry, they are used for carburetor testing, pneumatic conveying, food processing, cigarette tipping machines, aircraft component testing and many other applications.

Only Roots-Connersville vacuum equipment offers so many advantages — exclusive rotary positive design, ease of installation, efficiency of operation, and long years of trouble-free service. These features are the result of R-C's specialized experience of more than 100 years in the design and application of air and gas handling equipment.



For additional data, please refer to pages 565-568 in CHEMICAL ENGINEERING CATALOG, our section in MECHANICAL CATALOG or write for Bulletin VP-158.



**ROOTS-CONNERSVILLE BLOWER**

DIVISION OF DRESSER INDUSTRIES, INC.

459 Illinois Ave., Connersville, Indiana. In Canada—629 Adelaide St., W., Toronto



# Traylor-made kilns

feature

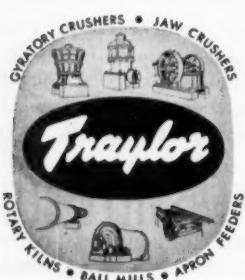
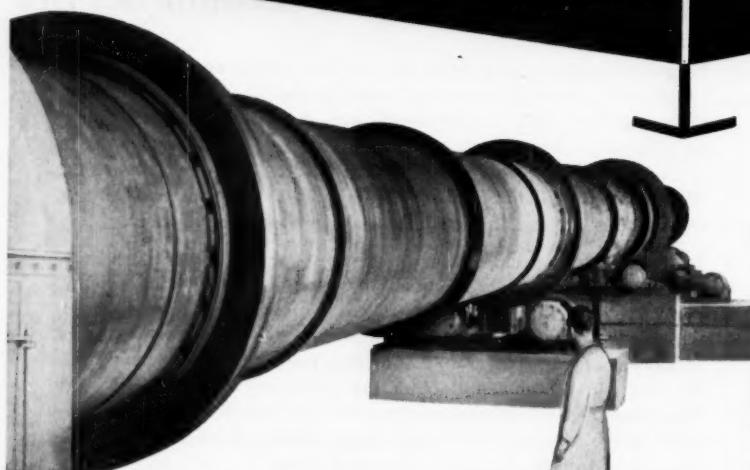
Operating Economy  
Advance Design  
Rugged Dependability



Traylor Rotary Kiln operating around the clock.



Traylor Rotary Kiln showing riding rings and thrust roller mechanism.



TRAYLOR ENGINEERING & MFG. CO., 1140 MILL ST., ALLENTOWN, PA.

Sales Offices: New York — Chicago — San Francisco

Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P. Q.

April 6, 1959—CHEMICAL ENGINEERING

# SERIES 40 GOBBLES UP EXTRA HEAVY CONDENSATE LOADS

This "thirsty" Yarway Impulse Steam Trap gives you all the well-known Yarway advantages like *quick heat-up, even temperatures, small size, good for all pressures, non-freezing*—PLUS the added feature of *huge capacity*.

For example, at 100 psig the  $\frac{3}{4}$ " size will handle 5600 lbs/hr; the  $2\frac{1}{2}$ " size, 62,000 lbs/hr.

Specify the Yarway Series 40 Trap for applications on large autoclaves, cooking kettles, heat exchangers, heating coils and other places where loads are heavy.

Buy the Yarway Series 40 from your nearby Industrial Distributor—more than 270 stock and sell the Yarway line. Over 1,250,000 Yarway Impulse Steam Traps already sold.



**YARNALL-WARING COMPANY**  
137 Mermaid Ave., Philadelphia 18, Pa.

## THE YARWAY FAMILY OF FINE STEAM TRAPS



**SERIES 60**—normal needs, pressures to 400 psi, 6 sizes. **SERIES 120**—normal needs, pressures to 600 psi, 6 sizes. **SERIES 40**—for extra heavy loads, 5 sizes. **NO. 30**—for extra light loads ( $\frac{1}{2}$ " only). **INTEGRAL STRAINER**—highest pressures and marine use, 6 sizes.

**YARWAY**

*impulse steam traps*

# Refinery licks tough heat exchanger crisis with emergency tube service

A sudden tube failure at the Pure Oil Company's Refinery in Lemont, Illinois, recently put Bridgeport's condenser tube service to the test. The failure hit on Friday afternoon—just before business slowed down for the week end. Faced with the prospect of costly equipment down time, the refinery called Bridgeport's Chicago office to find out how fast new tubes could be supplied. Here's a round-the-clock story of how the emergency was licked.



Friday, 2:30 P.M.: Salesman from Bridgeport's Chicago office learns that Pure Oil needs 900 Admiralty condenser tubes, and fast.



Friday, 3:00 P.M.: Salesman contacts our Bridgeport, Connecticut, mill and is informed that order can be delivered to Pure Oil Refinery in one week.



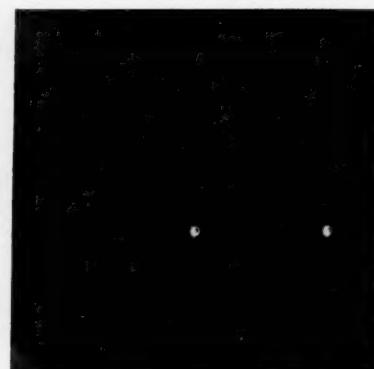
Friday, 3:30 P.M.: Sudden change in customer's needs makes immediate delivery of tubes imperative.



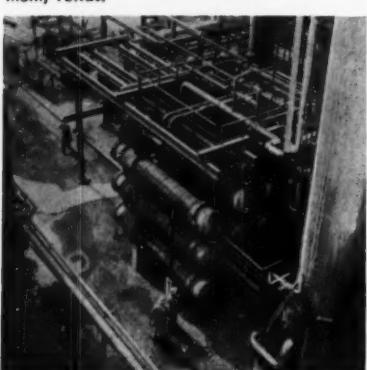
Friday, 4:15 P.M.: Chicago office checks through coast to coast network of Bridgeport warehouse stocks. Locates tubes at Beaumont, Texas.



Friday, 4:30 P.M.: Special night shift at Beaumont is put on job to cut tubes to special lengths and pack for shipment.



Saturday, 4:00 A.M.: Special truck leaves Beaumont, Texas, with order for Pure Oil Refinery in Lemont, Illinois.



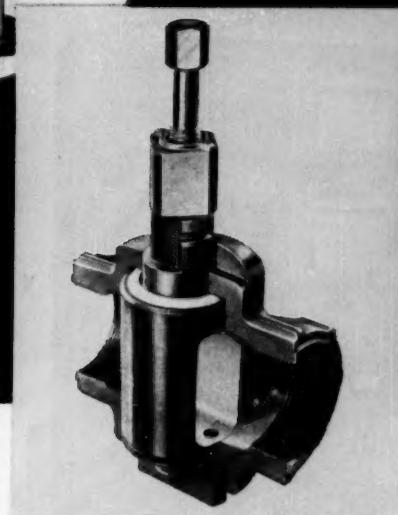
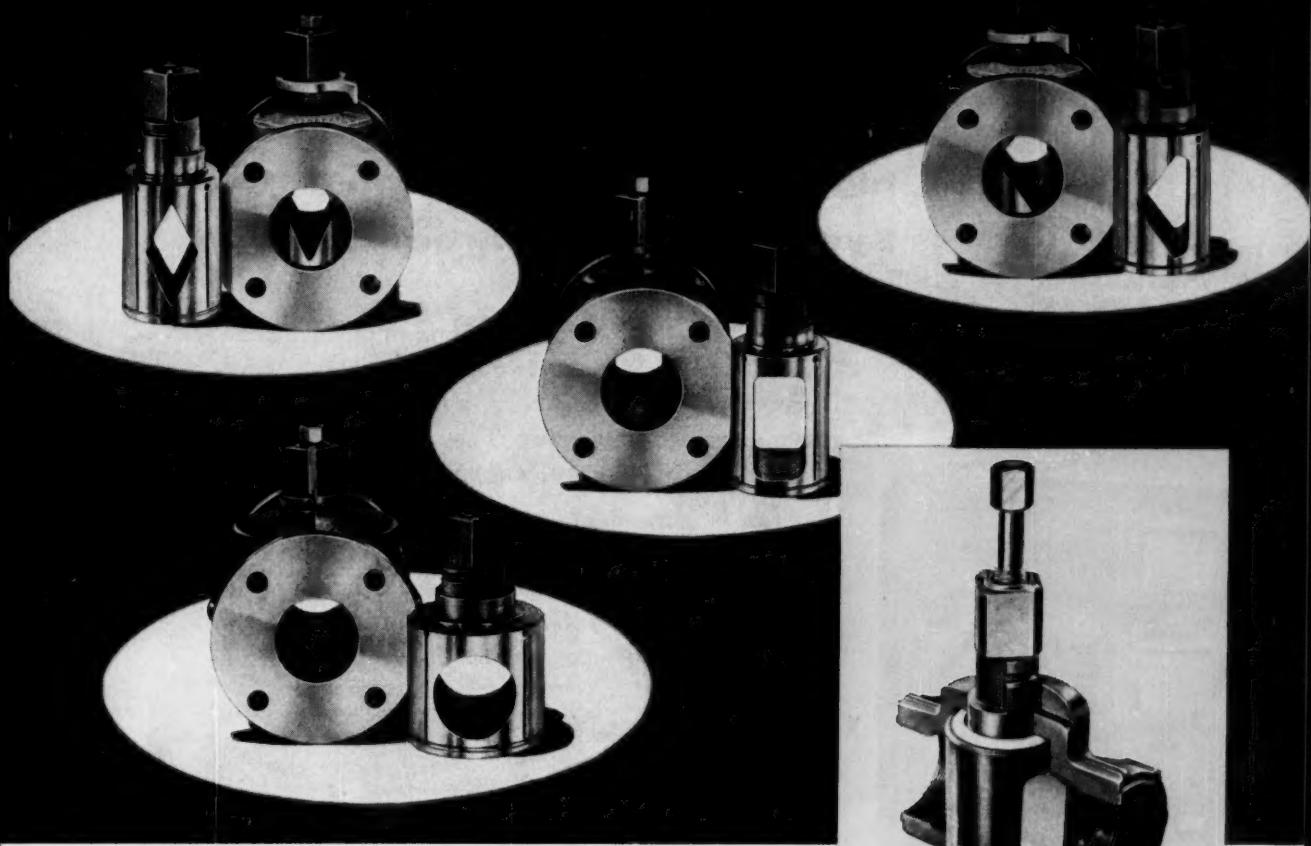
Sunday, 11:30 P.M.: Truck arrives at Lemont Refinery with 900 Admiralty tubes, ready for repair work to start Monday morning.



**BRIDGEPORT BRASS COMPANY**

Bridgeport 2, Connecticut • Sales Offices in Principal Cities

Specialists in Metals from Aluminum to Zirconium



## W-K-M's *Creative Engineering* assures the dependable performance of W-K-M's ACF Lubricated Plug Valves

Lubricated plug valves are the work-horse valves of industry. They're versatile, they're economical, they're readily available.

But one lubricated plug valve is not "just as good as another!" The ACF Cylindrical Plug Valve has many advantages.

W-K-M's creative engineering has designed the ACF valve to give you longer life, greater efficiency, minimum maintenance. W-K-M production pays constant attention to the manufacturing details that spell the difference between a "pretty good valve" and the best you can use. W-K-M tests every ACF valve against requirements much beyond the use for which it is rated.

In short, W-K-M's creative engineering assures you *dependable performance* from every ACF Lubricated Plug Valve in your plant.

### Advantages of ACF® Lubricated Plug Valves

These versatile valves have full pipe area openings. They provide through-conduit flow with minimum turbulence and minimum pressure drop.

They can be installed in any position. They can be serviced quickly.

They are safe against rupture while lubricating—excess lubricant escapes visibly to the atmosphere around the neck of the plug; this eliminates build-up of lubricant pressure, prevents lubricant from escaping into the line.

Lubricant protects against corrosion.

Available in semi-steel, Ni-resist, carbon steel, bronze and aluminum.

WRITE FOR CATALOG 400

**W-K-M**

DIVISION OF ACF INDUSTRIES  
INCORPORATED  
P. O. BOX 2117, HOUSTON, TEXAS



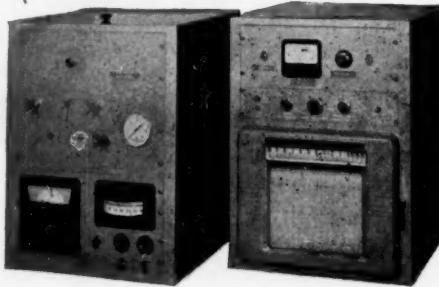
## Setting new standards— high-sensitivity Ionization Detection Systems for gas chromatography

Both the Model 10 and Model 20, now in production at Barber-Colman's Wheelco Instruments Division, offer sensitivities thousands of times greater than conventional gas chromatography units. They come completely packaged, ready for immediate operation.

You can be sure of always getting outstanding performance because of Wheelco's extensive experience with ionization detectors and the backing of a sales and service organization with branches in all principal cities. Below are some advantages of specifying Wheelco:

MODEL 10 provides single or dual operation, offers electronic integrator and automatic readout as optional equipment.

MODEL 20 is a compact, portable unit using capillary columns developed for both laboratory and industrial use. Integrator can be provided.



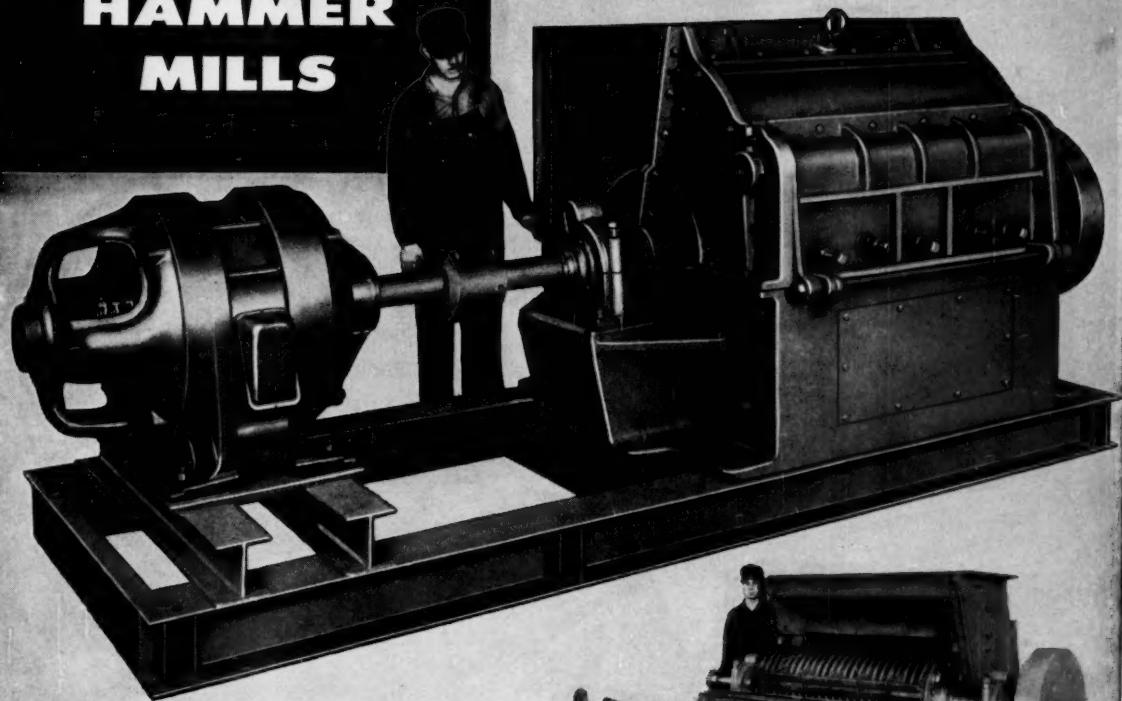
1. Column temperatures are precisely maintained to  $\pm .2^\circ \text{C}$  over a range of  $25^\circ \text{C}$  to  $300^\circ \text{C}$  without relays. Individual temperature control is provided for sample injection, column, and cell.
2. Dual-sensitivity controls are provided by 7 ranges of electrometer sensitivity plus continuously variable 0-2000 volt d-c power supply.
3. Flexibility and versatility for a broad range of applications are assured because you can select from glass columns up to 10 ft long,  $\frac{1}{4}$ -in. metal columns up to 20 ft long, or capillary columns up to 250 ft long for use with the Model 10. Either capillary columns up to 2000 ft long or  $\frac{1}{4}$ -in. metal columns up to 100 ft long are handled on the Model 20.
4. Modular, unitized construction makes principal components readily accessible, facilitates modifications and adaptations.
5. Outstanding performance is assured because:
  - (a) size of sample can be reduced for maximum efficiency with conventional columns.
  - (b) on capillary columns the advance design detector approaches sensitivities of  $10^{-15}$  moles; has been used to obtain efficiencies of over 200,000 theoretical plates.
  - (c) specialized detector arrangement makes it possible to identify classes of compounds whether in a mixture or by themselves.

## BARBER-COLMAN COMPANY

Dept. P, 1585 Rock Street, Rockford, Illinois, U.S.A.  
BARBER-COLMAN of CANADA, Ltd., Dept. L, Toronto, Canada

Industrial Instruments • Automatic Controls • Air Distribution Products • Aircraft Controls • Electrical Components  
Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

**WILLIAMS**  
*heavy duty*  
**HAMMER**  
**MILLS**



- **Crushes, Grinds, Shreds To Finished Size In One Operation**
- **Reduces Production Costs Up To 50%**
- **Saves Up To 75% On Equipment Cost**



Williams No. 60 GA Mill with heavy duty steel plate frame. Cover has been opened to show heavy duty manganese steel liners, breaker plates, grate bars and hammers.

Whether your size reduction job involves crushing, grinding or shredding—whether the material is mineral, chemical, vegetable or animal—Williams has a hammer mill designed to do it from start to finish in a single operation. More uniform product, increased output, plus savings in time and labor can cut production costs as much as half!

Extra primary and secondary crushers are seldom required with a Williams—no extra drives or

conveyors, no costly foundations or buildings for additional crushers are necessary. Expensive maintenance, replacement parts, excessive downtime and labor are reduced to a minimum.

Learn how a Williams hammer mill can step up your output, and improve your product quality. Write—explain your operation—and ask for a catalog.



**WILLIAMS PATENT CRUSHER & PULVERIZER CO.**

2706 N. 9th St.

St. Louis 6, Mo.

**WILLIAMS**  
 CRUSHERS & PULVERIZERS  
 Oldest and Largest Manufacturers of Hammer Mills in the World

**Experience—the added alloy in A-L Stainless, Electrical and Tool Steels**



## **Allegheny Ludlum knows more about stainless than anybody . . . and puts it in print for you**

Allegheny Ludlum *should* know more about stainless than anybody: they've been the leading producer of all forms for more than 40 years. And the industry's only that old.

Today, A-L produces more different sizes, shapes, finishes and alloys of stainless than any other company. Backing up its quality products are research and development facilities with people second to none.

With know-how and experience gained over the years, Allegheny Ludlum keeps little of it secret: it offers the most complete selection of literature available anywhere.

Literature, designed to help you learn more about Allegheny Stainless and how it can improve your product, is just one help offered by Allegheny Ludlum. You also get the best assistance from trained salesmen and technicians, ready to help you on your specific problem.

All this service is available through your Allegheny sales engineer. Call him today. Or, as a starter, write for the publication list describing the over 150 technical pieces made to assist you.

*Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pa. Address: Dept. CE-16.*

**ALLEGHENY LUDLUM**

for warehouse delivery of Allegheny Stainless, call RYERSON  
Export distribution: AIRCO INTERNATIONAL

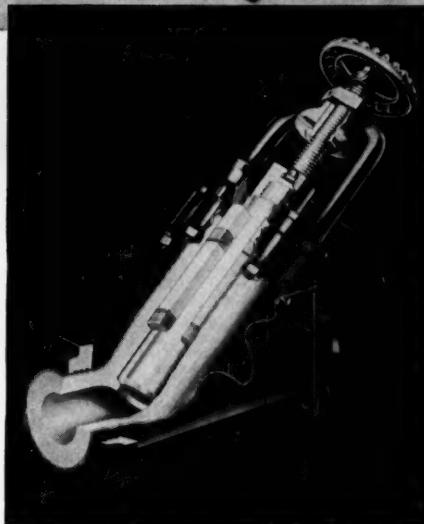
**EVERY FORM OF STAINLESS . . . EVERY HELP IN USING IT**



WSW 7188



**LOW-COST  
SECURITY  
FOR YOUR  
CHEMICAL  
LINES . . .**



**LAPP SOLID PORCELAIN VALVES  
WITH TUFCLAD<sup>®</sup> ARMOR**

Install Lapp Solid Porcelain acid proof valves and have that trouble-free chemical line you want—at a cost well within budget. With Lapp Valves in your system, you have the assurance of *purity, protection and permanence*.

Because of its many special characteristics, Lapp Chemical Porcelain is the *ideal material* for maintaining *strict purity*. It is chemically inert, therefore resistant to corrosion from acids of all concentrations (except hydrofluoric); it's hard, dense, pure, homo-

geneous, close-grained and non-porous. Impregnated and bonded to this porcelain by an Epoxy resin of high strength and chemical resistance is an armor consisting of multiple layers of strong fiberglass. This serves as an insulator against thermal shock, a cushion to accidental impact and is strong enough to hold operating pressure even if porcelain is fractured. Built-in seating handle, solid Teflon packing, spring washers, malleable iron trim and brass stud and bushing are other advantages that make Lapp Valves well worth your investigation.

**Lapp**  
**CHEMICAL**  
**PORCELAIN**

*WRITE for description and specifications.*  
*Lapp Insulator Co., Inc., Process Equipment*  
*Division, 2205 Chestnut St., LeRoy, N. Y.*

# NEW

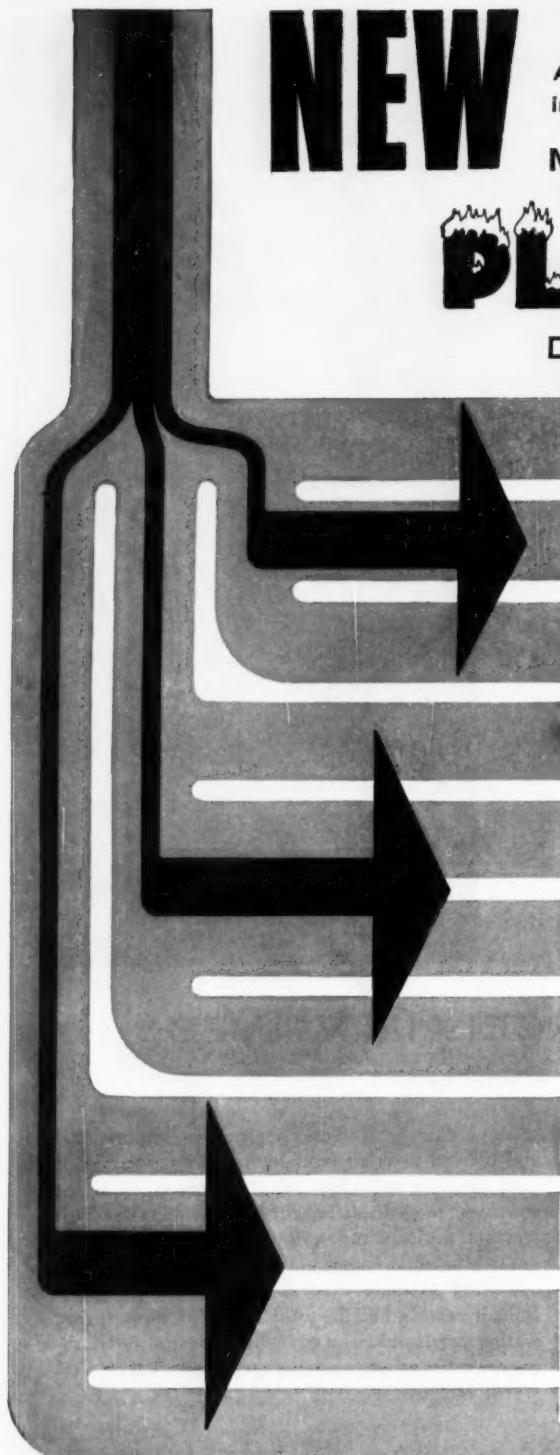
An exclusive \*TRANTER advancement  
in heat transfer technology

M U L T I - Z O N E

## PLATECOIL®

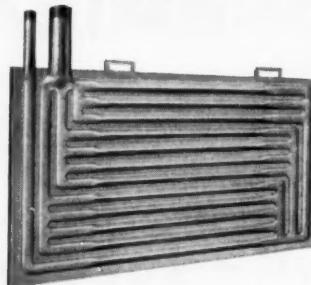
D E S I G N

\*PATENTS APPLIED FOR



### Years ahead performance plus all of the time-proven PLATECOIL advantages over pipe coils

The new MULTI-ZONE PLATECOIL features a multiple header configuration for improved steam distribution. The resulting increase in effective heat transfer area provides a built-in reserve capacity to deliver more heat during "start-up." It also speeds temporary recovery after introduction of work loads or processing ingredients for closer process control. Decreased condensate "trapping" produces FREE-FLO action.



A.S.M.E. APPROVAL FOR 250 psi. now makes it possible to apply the cost-cutting advantages of PLATECOIL to a new range of heat transfer problems. DURAWELD construction with TRANSTEEL mill-controlled mild steel provides a safety factor of 4 to 1 at 250 pounds steam.

Replace pipe coils with the new MULTI-ZONE PLATECOIL and save on tank space, fabricating, installation and maintenance costs. Factory-fabricated PLATECOIL is available in a wide variety of sizes and styles including single embossed, double-embossed, banked and rolled units in TRANSTEEL, Stainless, Carpenter 20, Monel, Hastelloy C and Nickel.

WRITE FOR NEW BULLETIN P61  
for complete specifications and data.

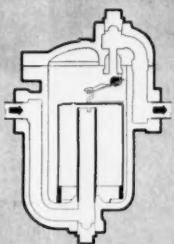
Tranter Manufacturing Inc.

LANSING 9, MICHIGAN

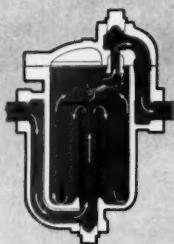


PLATECOIL®  
DIVISION

**This simple trap operating principle provides the efficiency, dependability and freedom from maintenance necessary for the most profitable use of steam**



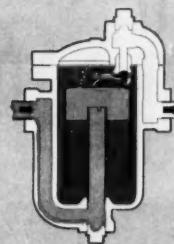
When trap is first installed, the inverted bucket is down and the valve is wide open.



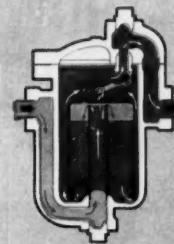
When steam is turned on, condensate (solid color) flows into trap and out through discharge orifice, until —



Steam (light color) reaching the trap floats the inverted bucket and closes the valve.



When more condensate enters the trap, the bucket loses buoyancy and pulls on valve lever.



When weight of bucket times leverage overcomes pressure on valve, bucket sinks and opens trap.

Key:

condensate

steam



steam bubbles



air bubbles

## ARMSTRONG INVERTED BUCKET STEAM TRAPS

are designed and made to give you these big benefits:

● Armstrong Traps, the first inverted bucket steam traps, now represent the most advanced development of this time-proven principle. They provide all the advantages necessary for efficient, economical condensate drainage from virtually all types of steam using equipment.

1. *No steam loss* — Steam never reaches the orifice even when there is no condensate load.
2. *Automatic air elimination* — Vent in trap bucket passes air and other non-condensables through to be discharged with condensate.
3. *No cooling leg required* — Condensate is discharged at steam temperature as fast as it reaches the trap because trap operates on difference in density between steam and water not on temperature.
4. *Operates on any back pressure* — Failure of one trap in system will not cause others to open because high back pressure does not affect an Armstrong trap other than to reduce capacity. As long as there is a

pressure differential across the orifice the trap will close on steam and open for condensate.

5. *Unaffected by ordinary dirt* — Swirling action of condensate keeps dirt in suspension until discharged with condensate, prevents it from lodging in valve.
6. *Completely dependable* — Proved design plus the use of all stainless steel working parts assure continuity of service and length of service unmatched by any other trap.
7. *Big capacity in a small, economical package* — Armstrong design gives you the highest practical capacity for any given pressure. And remember, Armstrong capacity ratings are based on *hot* condensate at the *working pressure differential* stated, not on theoretical orifice capacities.

Further information on these advantages plus much additional information is given in the 48 page Armstrong Steam Trap Book. Ask your local Armstrong Representative or write direct.



860 Series for low pressure heating service.



800 Series, side inlet, side outlet.



No. 801, side inlet, bottom outlet.



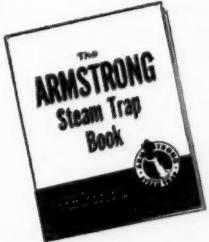
880 Series, integral strainer.



200 Series, bottom inlet, top outlet.



Forged Steel Series for high pressures, high temperatures.



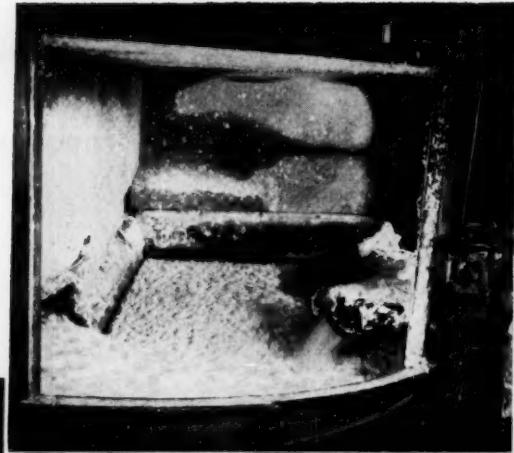
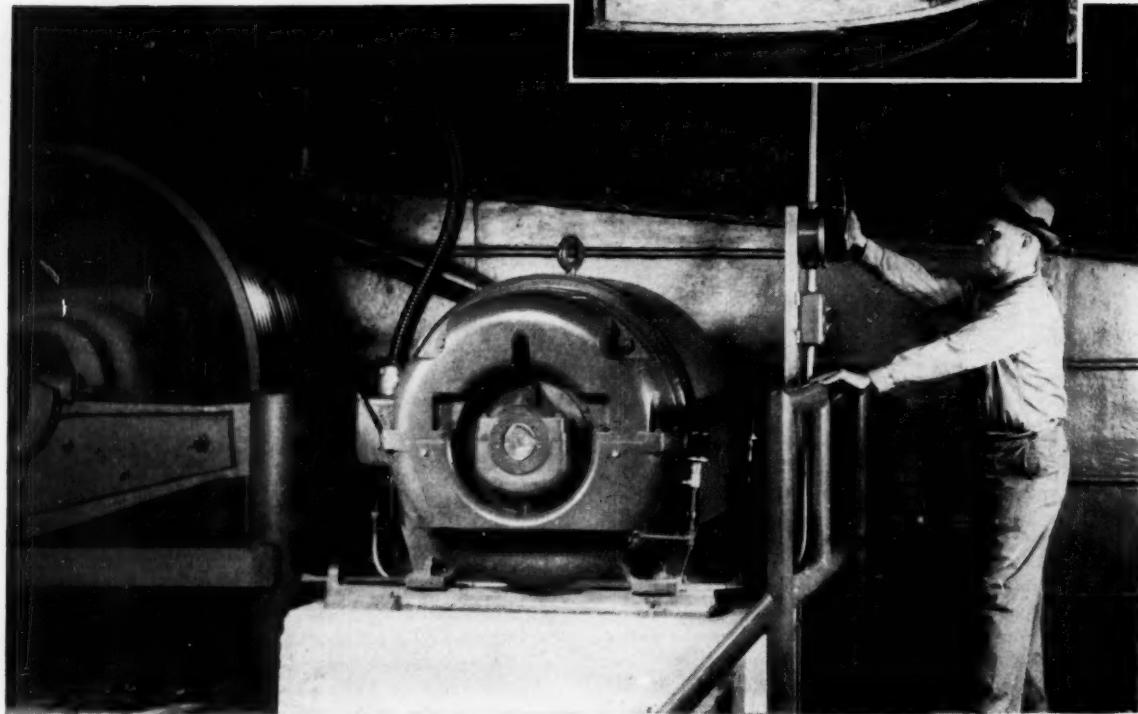
The 48 page Armstrong Steam Trap Book tells how to correctly size, install and maintain steam traps for any pressure, any temperature, any load plus full catalog data on Armstrong Steam Traps. Ask for Catalog K.



**ARMSTRONG MACHINE WORKS**

8584 Maple Street • Three Rivers, Michigan

# HOW TO BEAT A TON OF PULP...



Alton Box Board Company is one of America's most complete paperboard and packaging organizations.

The manufacture of paperboard, basic component of folding cartons and corrugated and solid fibre containers, is a complex process requiring massive machinery driven by powerful motors.

This top liner finishing beater, for example, is a giant "mixer" that beats 2000 pound batches of kraft pulp, mixed white paper, clays and water to form a highly liquid pulp. It is driven by a Wagner

150 hp low speed splashproof motor. The endplates are built in two sections to provide ready accessibility to the sleeve bearings.

Whatever your motor requirements may be, Wagner can build a special motor, or provide a standard motor to fit your need. Wagner builds motors in ratings through 1000 hp, with a wide variety of enclosure types and mountings. Call your nearby Wagner field engineer for an engineering analysis of your next motor application. There are Wagner branches in 32 principal cities.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

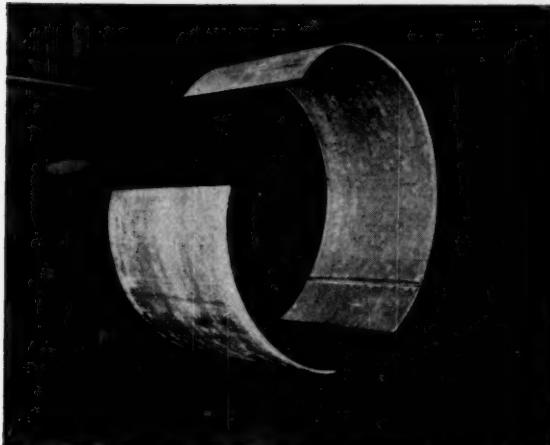
**Wagner Electric Corporation**

6407 PLYMOUTH AVENUE, ST. LOUIS 14, MISSOURI

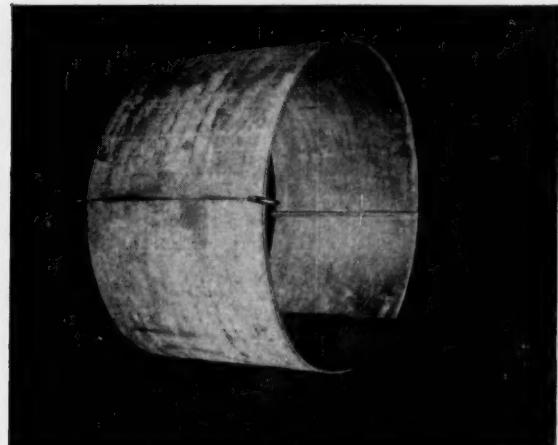
WM5B-4

SERVING 2 GREAT GROWTH INDUSTRIES... ELECTRICAL... AUTOMOTIVE

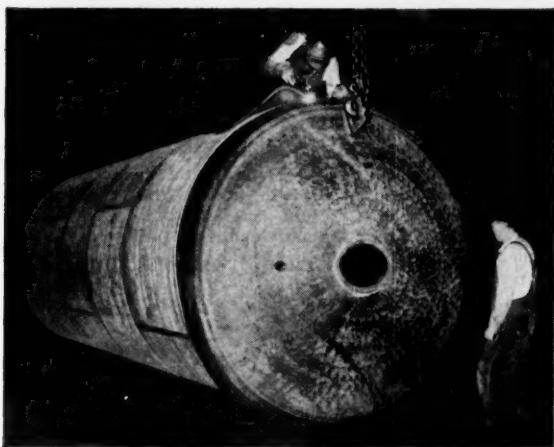
## Tanks, heat exchangers and processing equipment for tough jobs are fabricated quickly and easily of corrosion-resistant Everdur®



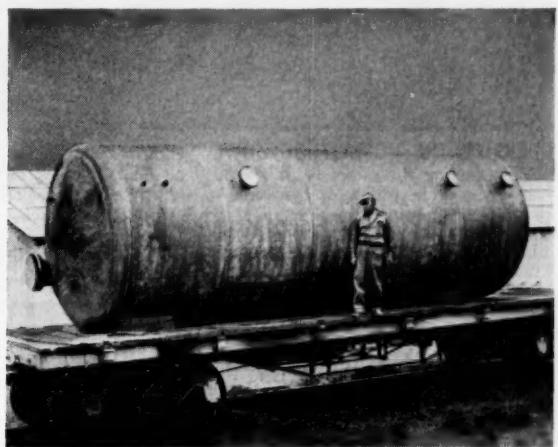
**At Old Dominion Iron and Steel Corporation, Belle Isle, Richmond, Virginia, (O.D.I.S.), fabricators of tanks, heat exchange equipment and pressure vessels, two plates of Everdur-1010 (151" x 56 $\frac{3}{16}$ " x .513"), previously welded together, are rolled to form a cylindrical tank section.**



**When rolling is completed** the beveled edges of the plates are butted to form a vee groove which then will be welded to complete the section. Five such sections will be put together by *Old Dominion Iron & Steel Corporation* to make the 26'-9" shell of the storage heater.



**The storage heater is completed** by attachment of two flanged and dished heads 96" outside diameter. The heads were press-formed and spun by *Old Dominion Iron and Steel Corporation* from circles of Everdur-1010, 104" in diameter and .674" thick.



**The completed 10,000-gallon storage heater** has 196 feet of welds. All welding was done with the inert-gas tungsten-arc using Everdur-1010 Welding Rod, which makes welds that meet ASME Boiler and Pressure Vessel Code requirements for soundness, strength, ductility.

EVERDUR-1010 provides the high strength and excellent corrosion resistance needed for all kinds of hot-water storage tanks and for pressure vessels and equipment used in the chemical and processing industries. This tank will be used for hot-water storage in a wool-dyeing plant.

High-strength, corrosion-resistant alloys, basically copper and silicon, are made and sold by The American Brass Company under its trade-mark, Everdur. They were developed for structural and engineering uses which require metals of high tensile strength combined with immunity to rusting, and corrosion resistance equivalent to that of copper. Everdur alloys are nonmagnetic, highly resistant to fatigue, and, depending on the alloy, suited to hot or cold working and economical fabrication by welding.

©1954

**EVERDUR®**

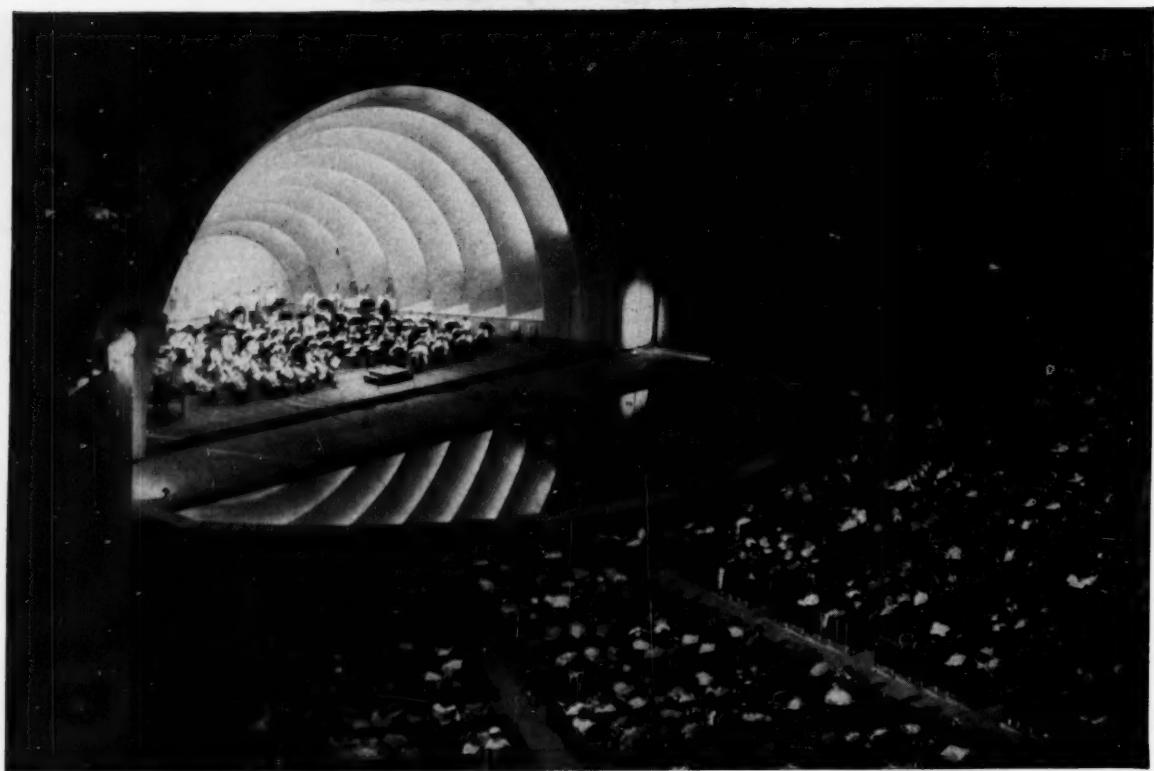
COPPER-SILICON ALLOYS

Products of

**ANACONDA®**

Made by The American Brass Company

# HOW *HERCULES* HELPS...



**BEAUTIFY THE HOLLYWOOD BOWL**—This crescent-shaped pool, reflecting the concrete-arch acoustical shell, doubles in brass as an orchestra pit, or is covered to add to the stage itself. Its surface is protected against such severe three-way usage by Nelsonite Pool Coating, based on Parlon® chlorinated rubber. Well over half of all the nation's swimming pools are likewise

protected with Parlon-based paints, for durability, weatherability, chemical and alkali resistance, and a smooth waterproof finish. Other Parlon-based coatings protect everything from waterworks to chemical plants, gondola cars to tugs and ships; and preserve the good looks of concrete and stucco homes and buildings. Consult your regular source of coatings.



**FEED HUNGRY SOIL**—Anhydrous ammonia, produced by Hercules plants in three important agricultural areas, replenishes nitrogen-deficient soils. Literally "injected" into the ground, the ammonic nitrogen combines almost instantly with soil particles. Applications can be made nearly any time of the year when temperature and moisture conditions are suitable.



**SERVE SOAP IN STYLE**—Bobrick's new line of soap dispensers features an unbreakable plastic globe made with Hi-fax® high-density polyethylene. Hi-fax is now being used in blown containers of many types, offering handsome styling durability and resistance to chemical corrosion in a low-cost, easily-processed plastic material.



**HERCULES POWDER COMPANY**

INCORPORATED  
900 Market Street, Wilmington 99, Delaware

**CHEMICAL MATERIALS FOR INDUSTRY**

# HERCULES

DEVELOPMENTS . . .

APRIL 6, 1959

# Chementator

C. H. CHILTON

**Universal Oil Products has just announced its new Molex process, which uses molecular sieves to separate low-octane normal paraffins from hydrocarbon mixtures in the gasoline boiling range. Object is lower-cost attainment of top octane ratings. Rejected stream of normal paraffins is a potentially valuable raw material for production of chemicals.**

**Chicago's Metropolitan Sanitary District decided last month to go ahead with a 300-ton/day, six-reactor plant to treat sewage sludge via Zimmermann wet oxidation process.**

**Prospective urea producers can now buy W. R. Grace's modifications to the Pechiney process along with the basic Pechiney license. Foster Wheeler will market the "new" Pechiney-Grace process package.**

## Polyisoprene rubber hits the market

From an unexpected source comes news of the first commercial-scale, competitively priced polyisoprene rubber.

Shell Chemical announced last month that it was producing 5 tons/day of polyisoprene in commercial equipment located at several Shell installations in the Los Angeles area. The company capitalized on availability of recession-idled equipment to pull its surprise move.

As additional facilities are installed, Shell expects to boost output to 15,000-20,000 tons/yr. Selling price is 30¢/lb., about the same as that for better grades of natural rubber.

U. S. Rubber has begun production of truck tires made of Shell's polyisoprene. The tire manufacturer plans to use the new rubber also in off-the-road, aircraft and white-side-wall passenger tires as supply is expanded.

Shell now seems to be unquestionably in the lead in the polyisoprene picture. Until last month, Firestone expected to be first, having announced plans for a 30,000-ton/yr. plant at Orange, Tex. (*Chementator*, Mar. 9, 1959, p. 72). Even this plant was due to start as a polybutadiene producer and later switch to polyisoprene, when and if warranted. Ironically, Shell had reported work on polybutadiene but had kept its polyisoprene activities under cover.

Although Shell will say nothing about how it gets its isoprene monomer, industry observers wager that Shell must have achieved a significant breakthrough in isoprene technology in order to sell the polymer at such a low price. Up to now, high cost of pure isoprene has deterred commercialization of polyisoprene rubber.

## Evaporation leads in fresh water race

Multiple-effect evaporation, one of the chemical engineer's favorite unit operations, has been tapped for the first of five government-supported demonstration plants to make

**SAFE!**  
**DEPENDABLE!**

**More Light!**

**Lower Operating  
Cost!**

**APPLETON®**

**MERCURY VAPOR Explosion-Proof Lighting Fixtures  
for Hazardous Areas**

250 Watt conforms to requirements for Class 1, Groups C & D Hazardous Locations  
... 400 Watt conforms to requirements for Class 1, Group D Hazardous Locations

All these exclusive features  
available only with **APPLETON**

- Standardized Unit Body permits a variation for mounting of fixture
- Gasket forms a positive seal between Unit body and dome unit assembly
- Connecting Block houses recessed contact springs through which line wires are connected with screw terminals
- Collector Ring and Center Stud are energized after five full threads have been encased
- Shock Absorbing "Lamp-Leck" Socket prolongs lamp life with its resistance to shock
- Porous Metal Cylinder serves as a flame arrester and permits breathing of fixture
- "Full-Circle" Venting acts as a louver to aid in an even distribution of heat
- Heat and Impact Resisting Globe detaches itself from fixture when globe ring is unscrewed
- Cast Aluminum Guard has six sturdy braces for fixture protection
- Mercury Vapor Fixtures available for 250 and 400 watt lamp sizes

■ Enjoy 2½ times as much light with maximum protection against burn-out, and benefit from lowest possible operating cost by installing **APPLETON** Mercury Vapor Lighting Fixtures! Where millions of dollars in capital investments are involved in oil refineries, chemical plants, coal mines, grain elevators, paint factories and other types of businesses with hazardous areas, explosion-proof, mercury vapor lighting is worthy of the most serious consideration. In these "AA-51" Series Vented Fixtures you get all the benefits of proven **APPLETON** design and sturdy, vibration-proof construction resulting from years of pioneering effort. Investigate **APPLETON**... the complete, interchangeable line that offers the maximum in protection, as well as a full complement of accessories including mountings, reflectors, and allied equipment. Write for full details!

*Sold Through Franchised Distributors Only*



Mercury Vapor Lamps:  
250 watt—C-H5 Clear  
—D-H5 Color Corrected  
400 watt—E-H1 Clear  
—F-H1 Color Corrected  
—S-H1 Silver White

**APPLETON ELECTRIC COMPANY**  
1701 Wellington Avenue • Chicago 13, Illinois

*"AA-51" Series  
Explosion-Proof  
Lighting Fixtures*



Ceiling Mounting



Pendant Mounting



Long Bracket Mounting



Short Bracket Mounting



1 million gal./day of fresh water from the sea. But other evaporation processes are still definitely in the picture.

While location of the first plant hasn't been set, Office of Saline Water has chosen the long-tube vertical evaporator system promoted by consulting engineers W. L. Badger & Associates, Ann Arbor, Mich., and pilot-planted at Harbor Island, N. C. (Dr. Badger died in November.)

Key to success of the LTV evaporator is a slurry-recirculation technique borrowed from the salt and pulp industries (Badger & Standiford, *Chem. Eng.*, Mar. 1955, pp. 173-177). The circulating slurry of calcium sulfate helps eliminate deposition of scale on the tube surface, even at higher operating temperatures than heretofore considered practical. Action of the slurry is both mechanical (scraping of the surface) and diffusional (nuclei for additional crystallization).

Number of effects, yet to be decided by an economic balance of first cost vs. steam consumption, may run as high as 12. Secretary of Interior Seaton looks for fresh water costs of less than \$1,100 gal.

Meanwhile, Mechanical Equipment Co., New Orleans, is after the contract for the next demonstration plant with an anticipated water cost (using standard OSW formula) of 70¢/1,000 gal. for its forced-circulation, vapor-compression evaporation unit.

MECO, established builder of vapor-compression units, says its new forced-circulation model will operate at 105 F., contrasted with operating temperature of 216 F. for its older natural-circulation units. There is no flashing in tubes, ergo, no scale, claims MECO. Lower temperature also means less corrosion.

And don't overlook multistage flash evaporation (*Chem. Eng.*, Oct. 1956, pp. 126-128). According to trade talk, the Sheikdom of Kuwait has just awarded the Scottish firm, G. & J. Weir Ltd., contract for a huge flash evaporation plant at a remarkably low price. Simplicity of construction (flash evaporators are essentially just big steel boxes) apparently gives this system an edge over tubular evaporators in first cost.

### New precursor to potent antibiotics

Britain's Beecham Group Ltd. is negotiating a contract with a major unidentified American pharmaceutical firm to exploit commercially its new penicillin compound from which

drugs can be tailor-made to treat specific diseases. Nearly every major pharmaceutical company in the U. S. has approached the British company, Beecham says.

Although commercialization of the new compound—called 6-amino penicillanic acid—is one to five years off, Beecham scientists hold out high hopes for the new product. By isolating the basic penicillin molecule, they say, it's possible to produce various types of penicillin to treat many diseases normally unaffected by penicillin. These include diphtheria, meningitis, leprosy, tetanus, typhoid, gas gangrene and gonorrhea.

The discovery also will be valuable against bacteria which have grown resistant to existing antibiotics, as well as for allergic patients.

### What price foreign-built equipment?

Price quotations for three 60,000-kw. generators	
Austrian manufacturer.....	\$2.5 million
Swiss manufacturer.....	2.6 million
British manufacturer.....	3.1 million
American manufacturers.....	4.3 million
	4.5 million
	4.7 million

Price quotations for one 500,000-kw. generator:	
British manufacturer.....	\$13.1 million
American manufacturers.....	19.5 million

While the "big three" automobile makers tool up to meet competition of foreign-built cars, the "big three" in electrical generators are seeking to offset foreign competition via legal maneuvers and the pressure of public opinion.

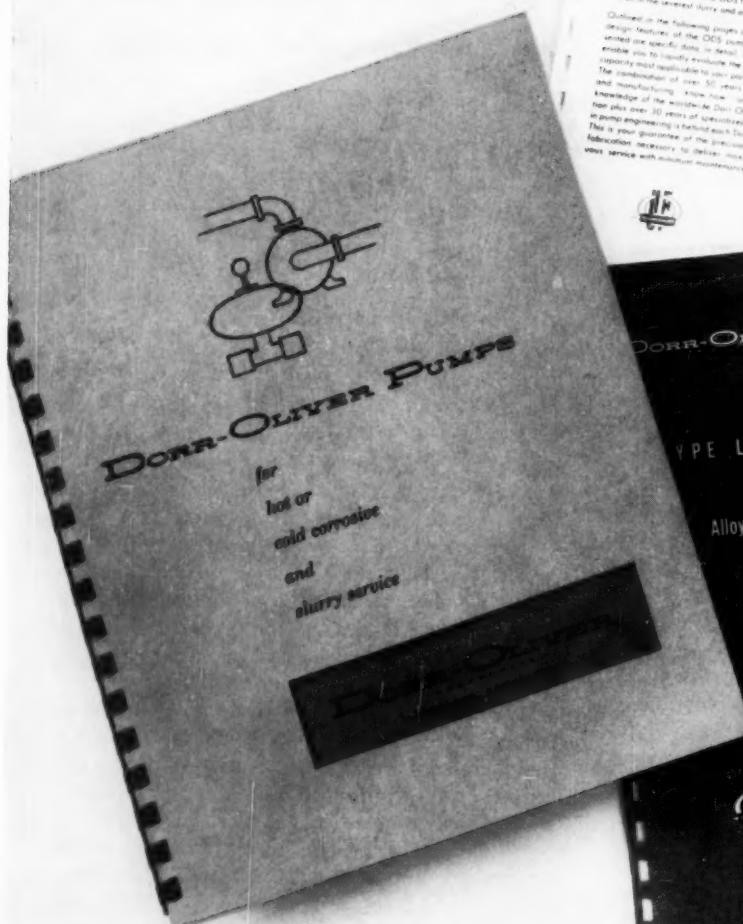
The generators referred to in the table above are being bought by Tennessee Valley Authority for installation in its power-producing network. As a government agency, TVA has complied with provisions of the Buy American Act and established national policies on foreign purchases. Despite these economic handicaps, as well as the penalties of import duties and shipping costs, foreign manufacturers were able to snare the two contracts.

Losing the order for the three smaller generators late last year elicited a strongly worded public statement from Allis-Chalmers to the effect that TVA was "ignoring its responsibility to play fair by spending the taxpayer's money in the same kind of an economy from which it gets it."

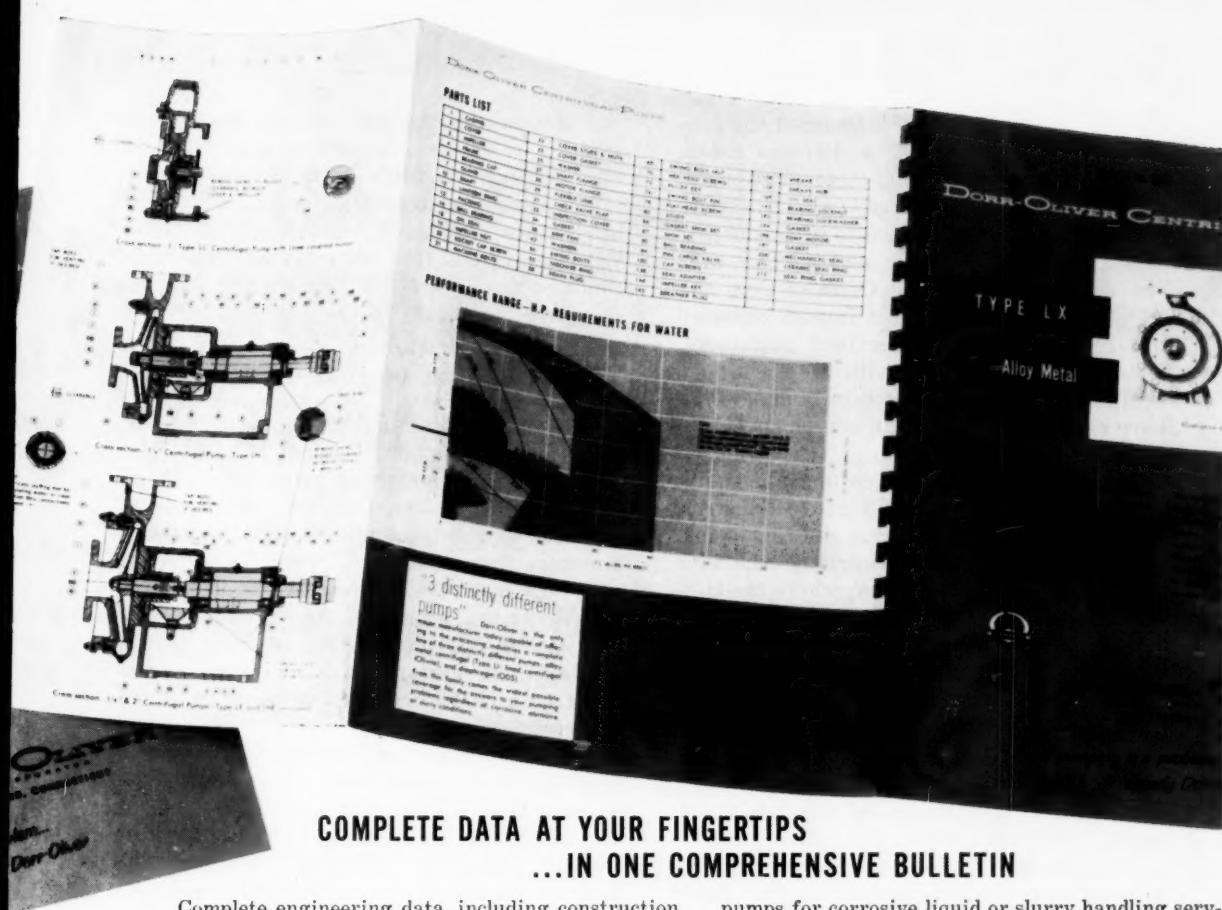
(Continued on page 72)

# ALL YOU WANT TO KNOW ABOUT PUMPS

for corrosive  
or slurry service



A stack of several Dorr-Oliver pump brochures and technical drawings. The top brochure is titled 'SLURRY ODS' and 'Dorr-Oliver Diaphragm Pumps'. It features a photograph of a pump unit with a motor and piping, and text about its design for corrosive and slurry service. Below it is a brochure for 'Dorr-Oliver Centrifugal Pumps' showing a side view of a pump. At the bottom of the stack is a brochure for 'TYPE LR' pumps, featuring a drawing of a pump and the text 'Illustrative drawing of Oliver Type LR Pump'.



## COMPLETE DATA AT YOUR FINGERTIPS ...IN ONE COMPREHENSIVE BULLETIN

Complete engineering data, including construction details, dimensions, capacities, performance curves, parts lists and application suggestions for the entire Dorr-Oliver line of alloy metal, lined and diaphragm-type pumps are given in this brand new bulletin... just off the press!

It places at your fingertips all the information you need for evaluating, specifying and servicing

pumps for corrosive liquid or slurry handling service — compiled by the only manufacturer making 3 entirely different pump types for complete coverage of difficult chemical industry requirements.

Get your copy now by writing to Dorr-Oliver Incorporated, Stamford, Connecticut, or by contacting the nearest of the nation-wide representatives and distributors listed below.

### REPRESENTATIVES AND DISTRIBUTORS

#### CALIFORNIA

Simonds Machinery Co.  
816 Folsom St., San Francisco  
Phone: Douglas 2-6794

Simonds Pump Company  
455 E. Fourth St., Los Angeles  
Phone: Madison 8-8321

#### GEORGIA

Rittelmeyer & Company, Inc.  
150 Nassau St., N.W., Atlanta 1  
Phone: Jackson 4-1531

#### ILLINOIS

Chemical Pump & Equipt. Corp.  
565 W. Washington Blvd., Chicago  
Phone: Andover 3-1881

#### LOUISIANA

R. V. Gildersleeve Company  
P. O. 2623, Baton Rouge  
Phone: Dickens 3-2338

#### MASSACHUSETTS

John J. Round, Jr.  
25 Wing Road, Lynnfield Center  
Phone: Lynnfield 4-4950

#### MICHIGAN

Kerr Machinery Company  
Kerr Building  
Corner Fort & Beaubien Sts., Detroit  
Phone: Woodward 1-0590

#### MISSOURI

Shutt Process Equipment Corp.  
5627 Manchester Ave., St. Louis  
Phone: Mission 7-0908

Shutt Process Equipment Corp.  
6317 Raytown Rd., Kansas City

#### NEW YORK

Chemical Pump & Equipt. Corp.  
75 West St., New York 6  
Phone: BO 9-7544

#### OHIO

Chemical Pump & Equipt. Corp.  
3537 Lee Road, Cleveland  
Phone: Longacre 1-3025

Chemical Pump & Equipt. Corp.  
1717 Section Rd., Cincinnati  
Phone: Elmhurst 1-5765

#### PENNSYLVANIA

The Cunningham Company  
101 Investment Bldg., Pittsburgh  
Phone: Court 1-7092

#### Equipment Engineers Inc.

331 E. Lancaster Ave., Wynnewood  
Phone: Trinity 7-2539

Equipment Engineers Inc.  
134 E. King St., Lancaster  
Phone: Express 3-2197

#### TENNESSEE

Shutt Process Equipment Corp.  
P. O. 894, Memphis.

#### TEXAS

M. N. Dannenbaum Company  
P. O. 14496, Houston 21  
Phone: Walnut 3-7655

#### UTAH

The Galigher Company  
545 W. 8th South St., Salt Lake City  
Phone: Elgin 9-8731

#### VIRGINIA

The O'Neill Pump & Engineering Co.  
601 E. Franklin St., Richmond  
Phone: Milton 4-4828

Name \_\_\_\_\_

Company \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_



Please send me your new complete pump bulletin

Then in February TVA awarded the contract for the big job to C. A. Parsons & Co., Ltd. The two unsuccessful bidders, General Electric and Westinghouse (Allis-Chalmers declined to bid), are reported to be conducting a campaign to upset this award. The U.S. firms have appealed to the Office of Civil and Defense Mobilization for an import embargo on such defense-critical electrical machinery. TVA recently countered with an eight-page rebuttal supporting its decision and leveling sharp criticism at American equipment builders.

Engineers who either buy or make equipment used by the chemical process industries are vitally concerned with this question of foreign competition. This is especially true with purchases by private industry, where the U.S. equipment builder does not enjoy the same degree of protection afforded him as when selling to government agencies.

### London broils with U.S. methane

First transoceanic shipment of liquid methane was "completely and absolutely successful," says British Gas Council.

The *Methane Pioneer*, which arrived February 20 at Canvey Island in the River Thames, unloaded its historic 2,000-ton cargo without a hitch into specially built storage tanks. Shortly thereafter, the methane was on its way through a catalytic reforming process and then to "town gas" consumers in the London area.

In the 23-day voyage from Lake Charles, La., evaporation loss was less than 10%—somewhat under engineers' early estimates of 0.5% per day. Special unloading pumps—one centrifugal, the other reciprocating—functioned without trouble, as did all other equipment. There was no detailed examination of the balsa-lined-aluminum shipboard tanks, since their extremely low temperatures precluded entry while ship was in England.

At last report the vessel, jointly owned by Constock Liquid Methane Corp. and British Gas Council, was on its return trip to the U.S. Cargo tanks will get thorough inspection here before the next journey.

Although the *Methane Pioneer* is not equipped to recover the methane lost by evaporation, Constock is now designing a tanker that will use this vapor to supplement its fuel supply. The company visualizes commercial methane tankers of up to 40,000 tons.

Meanwhile, the French this month are starting work on a similar project. Liquid methane would come from the Sahara's Hassi R'Mel field. Development is being carried out by Societe d'Etude du Transport et de la Valorisation des Gases Naturels du Sahara, a combine formed by Air Liquide and four oil companies operating in the Sahara.

### Pilot plant runs on computer control

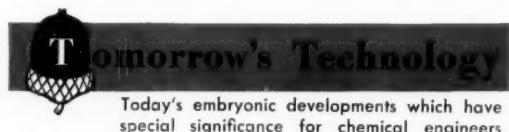
Although closed-loop computer control of a continuous chemical process is still to be achieved in a commercial plant (*Chem. Eng.*, Mar. 9, 1959, p. 88), Universal Oil Products has been operating a small pilot plant this way for more than a year.

This was revealed last month in a joint announcement by UOP and Daystrom, Inc. The latter firm, located at La Jolla, Calif., combined its systems know-how and equipment with UOP's process know-how to attain the significant result.

Daystrom is eager to apply this same combination of talents to commercial processing installations. The company is convinced of the wisdom of this joint approach to computer control systems, fundamentally opposing the idea of an all-purpose, off-the-shelf process-control computer.

To put an existing process under computer control, Daystrom proposes to bring a data logger into the plant and record process variables for several weeks. Mathematicians then take over and reduce these data to meaningful programming terms.

The Daystrom computer would work through conventional process control elements, automatically optimizing operations by calculated adjustments of controller set-points. Economic justification would spring from improved operating efficiencies and better quality control.



### ◆ Acetaldehyde forms rubbery polymer

A new elastomer recently synthesized in Japan claims attention on the basis of unusual composition, potentially low price and high heat resistance.

(Continued)

# AN IMPORTANT MESSAGE

## To *Sulfuric Acid Users* with

### **Waste Disposal Problems**

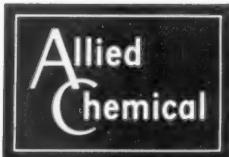
If handling and disposal of large quantities of sulfuric waste materials presents a problem for you—here's the answer:

#### 13 General Chemical plants equipped to handle spent sulfuric!

Anacortes, Washington  
Baton Rouge, Louisiana  
Buffalo, New York  
Denver, Colorado  
East St. Louis, Illinois  
Elizabeth, New Jersey  
El Segundo (Los Angeles), California  
Hegewisch (Chicago), Illinois  
Newell, Pennsylvania  
North Claymont, Delaware  
Port Chicago (San Francisco), California  
Richmond (San Francisco), California  
River Rouge, Michigan

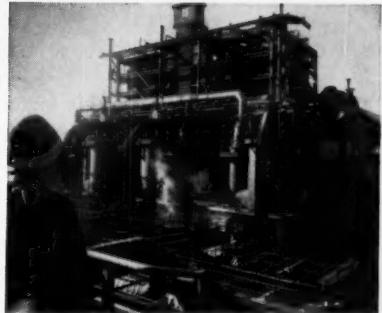
These plants provide unmatched experience, service and facilities to customers interested in recovery of spent acid. The service and performance of these plants are certain. Behind them stand the resources and experience of Allied Chemical's General Chemical Division, the nation's primary producer of sulfuric acid, and pioneer in recovery of sulfuric waste products.

Our experience and facilities are at your service. For further information, write or phone our nearest sales office.



**GENERAL CHEMICAL DIVISION**  
40 Rector Street, New York 6, N.Y.

Offices: Albany • Atlanta • Baltimore • Birmingham • Boston • Bridgeport • Buffalo • Charlotte • Chicago • Cincinnati • Cleveland (Miss.) • Cleveland (Ohio) • Denver • Detroit • Houston • Jacksonville • Kalamazoo • Los Angeles • Milwaukee • Minneapolis • New York • Philadelphia • Pittsburgh • Portland (Ore.) • Providence • San Francisco • St. Louis • Seattle • Kennewick • Vancouver and Yakima (Wash.)



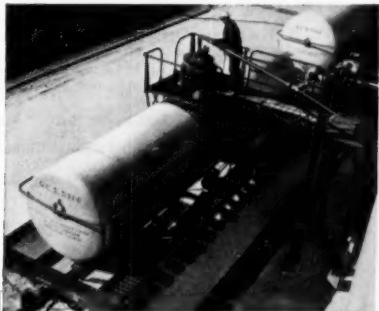
Typical of General Chemical's modern sulfuric acid facilities is our Delaware Works. A part of this plant is seen above.



One of General Chemical's fleet of large coastal barges for low-cost transportation of spent and virgin sulfuric acid. If your plant is near a coastal waterway consult us about possible savings.



Over-the-highway service is provided by large fleets of tank transports. Sulfuric customers are assured of prompt service.



By far the largest fleet of sulfuric tank cars is operated by General Chemical, providing efficient, dependable, continuous service.

The new material is made by polymerizing acetaldehyde in the presence of aluminum oxide catalyst. Synthesizer Junji Furukawa, of Kyoto University, estimates manufacturing cost at 12-15¢/lb., about half the cost of natural or styrene-butadiene rubbers. Its heat resistance is said to significantly exceed that of SBR.

Product is chemically related to Du Pont's polyformaldehyde, Delrin. A thermoplastic resin, Delrin retains almost one-fourth of its room-temperature stiffness at 250 F. and has high heat-distortion temperatures.

Du Pont tells *CE* that its researchers have also synthesized rubbery polymers based on acetaldehyde. Elastomeric characteristics are the result of long, coiled molecules, unlike the crystallinity of Delrin's linear molecule. To date Du Pont has not hit the right combination of stability, quality and cost to offer commercial promise.

Lacking unsaturation in its molecule, polyacetaldehyde rubber would have to be cured by irradiation or other non-sulfur techniques. On this basis alone, one rubber industry spokesman doubts its potential for low-cost production in the near future.

### Will epoxies check wool's decline?

A chemical treatment developed by Uncle Sam may help the wool industry check the downward trend in its markets.

Dept. of Agriculture's Wool and Mohair Laboratory at Albany, Calif., reports promising results from experimental treatment of wool garments with a dipping emulsion of a modified epoxy resin, followed by mild heating. Objective: A wash-and-wear woolen garment that holds its shape, size and appearance even after repeated washing.

If commercially successful, this work would put wool in a better competitive position relative to synthetics.

Resin treatment of fibers, first developed for use with rayon, has really boomed in the cotton business. But textile-chemical experts are rather cautious in their assessment of the prospects for successful treatment of wool. Rohm & Haas has toyed with application of its Rhoplex acrylic emulsions to wool but thinks it will be a tough market to develop. Shell Chemical, supplier of epoxy emulsions to the USDA researchers, is a bit more optimistic. Shell looks upon the potential market as big enough to be "interesting."

### Research and development briefs

**Electrolytic refining of beryllium** is being tried by Bureau of Mines at Boulder City, Nev., in an experimental 250-amp. cell. Object is to make high-purity metal of spectrographic grade, starting with 94% anodes. Bureau also plans to try electrorefining of yttrium.

**Molten polyethylene is solvent** in Phillips-type polymerization process proposed by R. Mihail of Roumanian Institute for Chemistry, Bucharest. He obtained a polyethylene with molecular weight of 40,000 by introducing ethylene into a polyethylene melt at 140 C. and 40 atm., using a chromium oxide catalyst.

**Shape of pigment particles** affects moisture permeability of resulting paint film. Workers at New York University are studying the influence of particle shapes, such as circular, platy, fibrous or acicular. They find that platy materials, such as wet-ground mica, provide a high degree of moisture sealing in paint films.

**New form of boron** has been discovered by General Electric scientists, reconciling conflicting evidence of crystallography with conventional rules of chemistry re sharing of electrons. Research on boron hydride fuels has revealed boron's ability to form "delta" bonds, in which three atoms share an electron pair.

**Combustion researchers** at University of Wisconsin mix fluorescent dyes with liquid fuels so that atomized droplets can be more easily photographed.

**Chemical stabilization of soil** has a big potential in the years ahead, predicts Ronald Scott, Cal Tech civil engineer. He envisions the day when a machine moving over the ground will pick up dirt in front, mix in chemicals and spew the product out the back to form a completed strip of highway. One promising experimental chemical for this purpose is tetrasodium pyrophosphate.

**Flavofungin, a new antibiotic** developed in Hungary, is claimed to be efficacious in healing skin diseases caused by fungi. Promising results have attracted interest of "several foreign firms," among them one American.

For more on DEVELOPMENTS.....76

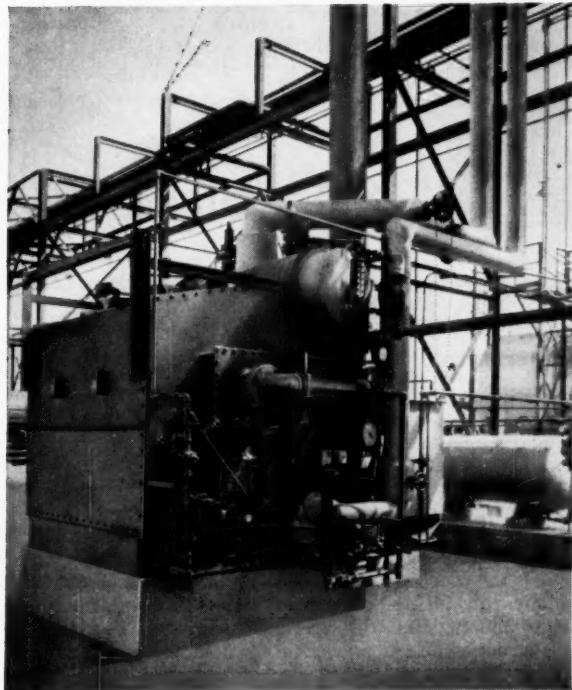
During the past **23** years

**ONE** large chemical company

has installed **54**

**FW VAPORIZERS**

*... with a total capacity of **310,619,000 Btu/hr***



Typical outdoor installation of a 2,000,000 Btu/hr FW Vaporizer using Dowtherm.

**R**EPEAT orders from satisfied customers account for the majority of Foster Wheeler's business in the process heating field. For example, one large chemical company has been using FW Vaporizers for 23 years. They now have installed 54 units with a combined capacity of 310,619,000 Btu/hr.

In this specialized process heating equipment, the importance of Foster Wheeler's quarter-century of *experience* cannot be overemphasized. FW Vaporizers using Dowtherm\* have been supplied for over 600 installations in sizes ranging from 44,500 Btu/hr to 45,000,000 Btu/hr.

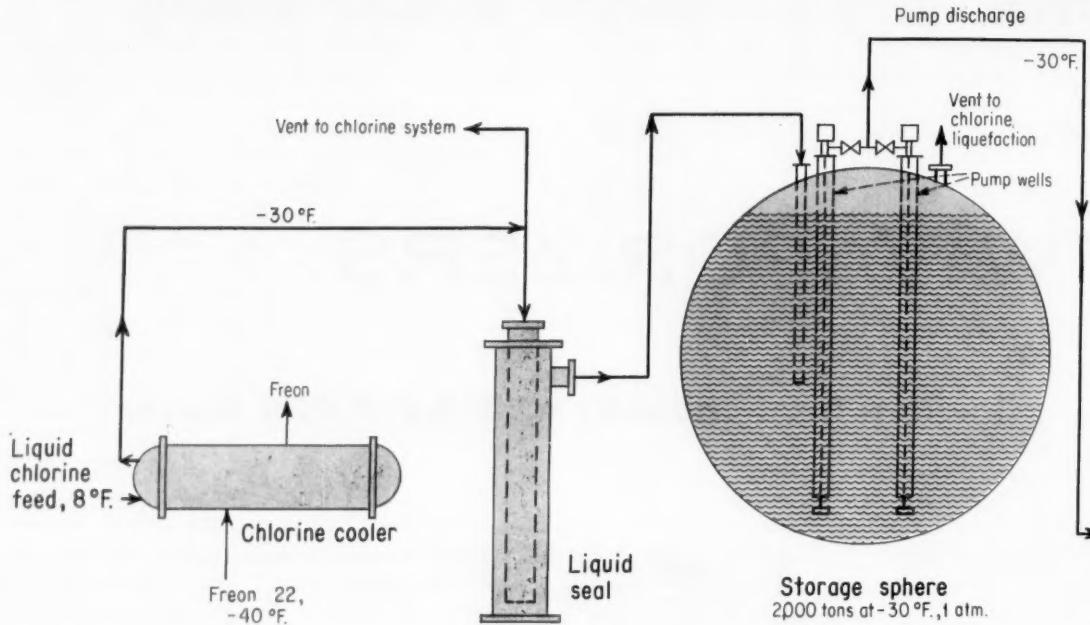
Based on this experience gained in hundreds of applications to different processes, FW analyzes your *entire process heating system* before recommending a design. FW then does the complete job — designs and builds the Vaporizer, installs it in your plant, puts it "on stream" and makes sure that everything functions at top efficiency.

For information on the equipment best suited to *your* process heating requirements, write to *Foster Wheeler Corporation, 666 Fifth Avenue, New York 19, New York.*

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## Plant Finds Cold Storage Is Safer Storage for

**Pioneer move converts ambient-temperature, high-pressure storage of liquefied gas to atmospheric-pressure storage below gas liquefaction temperature.**

At Natrium, W. Va., Columbia-Southern Chemical Corp. has taken the wraps off chlorine storage facilities believed to be the safest in existence for large quantities of chlorine.

Secret behind Columbia-Southern's achievement—safe storage of 2,000 tons, or more than 300,000 gal.—is to store the chlorine as a refrigerated liquid at atmospheric pressure. It's the same secret that's behind Atlanta Gas Light's propane storage (*Chem. Eng.*, March 23, 1959, p. 112) and much of the development work under way on marine transportation of liquefied gas (*Chem. Eng.*, April 21, 1958, p. 53).

► **Safety Foremost** — After two years of successful operation

Columbia-Southern Project Engineer P. R. Olegar and Chlorine Area Supt. W. E. Swisher are confident that they have achieved their primary objective—maximum safety in the storage of liquid chlorine. So conservative, in fact, was the design of this pioneering installation that Olegar and Swisher now feel that they could effect further economies without compromising the system's inherent safety.

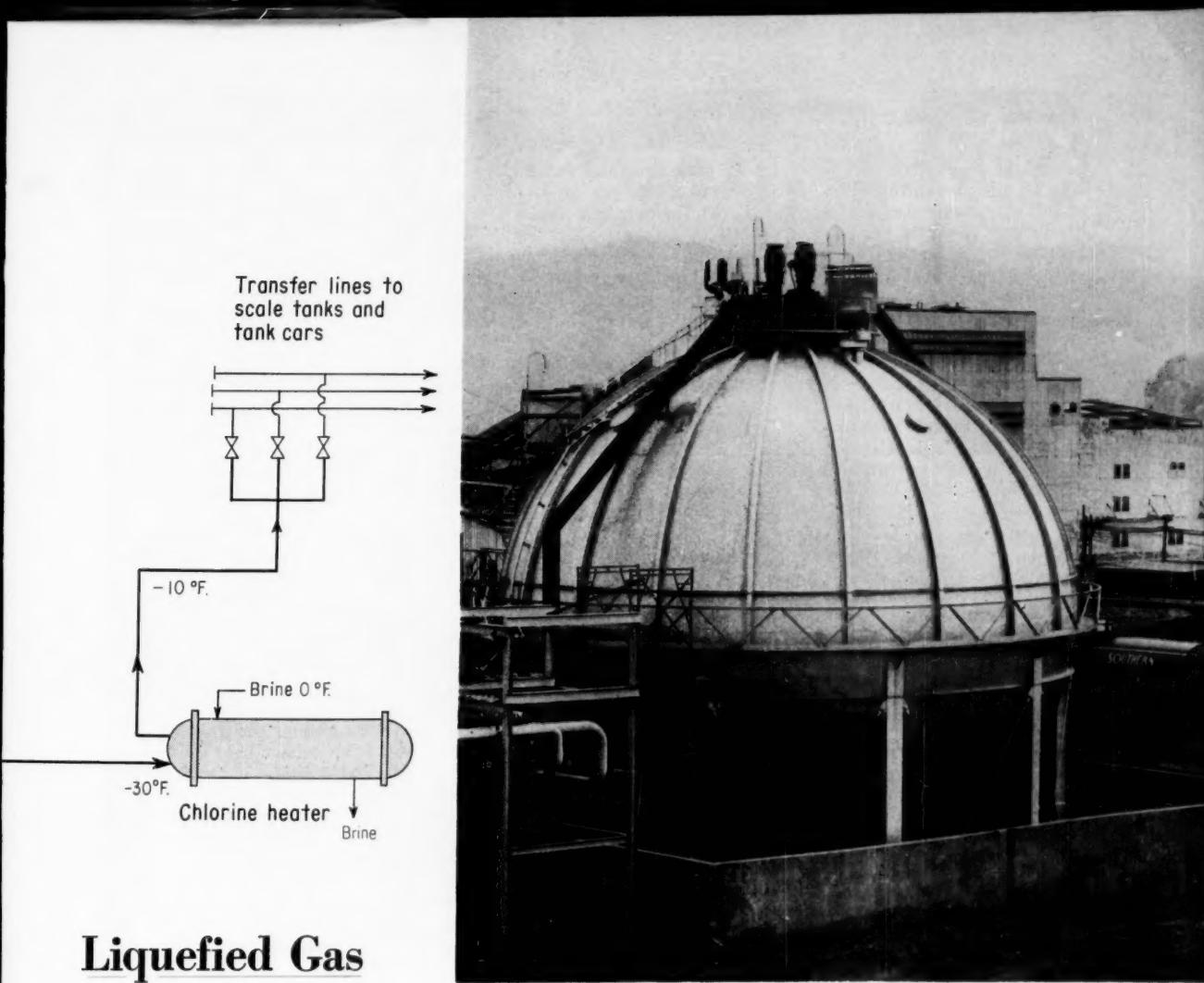
► **Reverse the Approach** — Liquid chlorine storage traditionally has involved heavy walled vessels of comparatively small capacity—100 to 150 tons. Shop fabricated to rigid design specifications, such vessels can hold

the pressure required to keep chlorine liquid at ambient temperatures.

Nevertheless, C-S believed that even safer chlorine storage was attainable, perhaps through refrigeration to  $-30^{\circ}\text{F}$ ., chlorine's liquefaction temperature at atmospheric pressure.

Before long, C-S engineers found that refrigerated, low-pressure liquid chlorine storage had a potential which transcended the small conventional vessel. Tanks of 1,000-2,000 tons were feasible. Thus, the method eventually selected is based on storage of liquid chlorine in a 45-ft. insulated sphere at approximately atmospheric pressure.

► **Cool by Vaporization** — Liquid temperature is maintained near chlorine's boiling point of  $-30^{\circ}\text{F}$ . at 1 atm. by continuous vaporization of chlorine which removes heat penetrating



## Liquefied Gas

through the vessel walls. Vapor is removed and reliquefied in an external refrigeration unit. When sphere is full, vapor occupies 14.1% of total sphere volume.

Should the low-pressure system rupture from any cause, the liquid chlorine will not flash off. Instead, it will evaporate relatively slowly as it contacts warmer objects; the amount of gas formed will be quite small. ► **Develop New Pump**—In order to remove liquid chlorine from low-pressure storage C-S needed a satisfactory vertical pump to discharge liquid from the top of the vessel. Ordinary transfer methods via padding or blowing with dry air under pressure would preclude use of a thin-wall, large volume tank.

The pump was forthcoming—a multistage, long-shaft, sump-type centrifugal developed by Columbia-Southern, long enough

to reach nearly to the bottom of the 45-ft. storage sphere.

Chlorine tank is equipped with two of these pumps, one being a spare. Pumps have double stuffing boxes. Dry air, at slightly elevated pressure, feeds between stuffing boxes. Bleeding in both directions, this air prevents leakage of chlorine to atmosphere.

Intermediate bearings on long pump shafts are graphite-filled Teflon which get lubricated by side stream of chlorine circulating from pump discharge.

Pumps sit in wells which expose only a small liquid-surface area when pumps must be removed for any reason. Before reinsertion in well, pump is cooled with dry ice to avoid breakage from thermal stress and to lessen flashing of liquid chlorine into vapor.

If discharge piping should rupture during pumping, result-

ing excess flow actuates check valves inside sphere. When pumps are not operating, storage at atmospheric pressure is its own check valve.

► **How C-S Controls Level**—Columbia-Southern tries to keep at least 200 tons of chlorine in tank at all times. An empty tank warms quickly; recooling with cold gas would be necessary once the temperature passes a certain point. And lack of lubrication and vibration would result if the pumps went dry.

To guard against these low-level conditions, C-S continually monitors liquid level with a servo-balanced radioactive source and detector. Cesium-137 source, located in one vertical pipe, is coupled to detector in another pipe so that both move up and down in unison with the rise and fall of liquid level.

Columbia-Southern's engi-

neers believe this detector which relies on differential absorption of gamma radiation by liquid and vapor is the first of its type, report accuracy within  $\pm$  in. of true level.

► **Test for Sphere**—Inner sphere is a Pittsburgh-Des Moines-Steel Icososphere. Constructed of ASME-203 firebox-grade-B steel, sphere is designed for 14.7 psig. external pressure and 33 psig. internal pressure at -50 F., in accordance with the 1952 ASME Code for Unfired Pressure Vessels.

To assure satisfactory shock resistance at the low storage temperatures, steel for the sphere and flanges was manufactured and tested according to ASTM Specification A-300. Complete analyses and mill test reports on steel-making substantiated metal quality.

As a further safety precaution, an extra  $\frac{1}{2}$ -in. thickness was added to inner shell wall even though dry liquid chlorine is not corrosive at ambient temperature or lower. Total thickness of shell: 0.91 in.

Although designed to code requirements, inner sphere underwent x-raying of all welds to assure final quality. And the hydrostatic test was carried up to  $3\frac{1}{2}$  times the design pressure. Finally, inner sphere was halogen-tested for leaks at 106 psig.; outer sphere passed air test with soap bubbles at 5 psig. design pressure.

As a further precaution, system has two 4-in., spring-loaded relief valves set at 15 psig.  $\pm$  0.5 psig. A graphite disk set at 5 psig. protects the relief side of the valve from atmospheric corrosion.

After two years of service, inspection showed the tank to be in nearly perfect condition. There's no evidence of corrosion. Welds are all sound and even the remaining mill scale seems tight.

► **Inner and Outer**—Inner sphere, or Icososphere, is cradled in the outer sphere with its weight distributed through the lower third of its surface which rests on 0.5-in. of special-density quartz-glass-fiber insulation supported by 11.5 in. of Foamglas lining inside surface of the outer shell.

Upper two-thirds of the space between spheres is filled with expanded volcanic ash, a loose-fill insulation. Air, dried to -40 F. dew point, circulates through loose insulation at 1 cfm. to keep moisture from collecting and freezing on inner sphere.

Large temperature gradient across spheres required use of stainless-steel convoluted expansion joints on nozzles passing through two spheres.

Entire double sphere sits in a pit enclosed by a concrete dike—an emergency container for the sphere's contents in case of rupture.

► **Ready to Fill**—Before vessel could take liquid chlorine, C-S had to circulate 2,500 lb./hr. of chlorine gas at about 0 F. through tank for nine days. By then, temperature varied only 25 F. between top and bottom of sphere which approximates the 25-40-F. variation when loaded with liquid chlorine.

Liquid chlorine at about 8 F. enters storage system through tubular heat exchanger for pre-cooling to -30 F. with Freon 22. Cooled chlorine then moves on to storage sphere by way of a seal which prevents inert gas carryover in case of operating irregularities.

Entering inner sphere, chlorine passes down 4-in. pipe leg which is blanked off and slotted along sides near bottom. Slots feed the cold liquid over a wide area of tank bottom, avoiding sudden localized chilling of the metal and accelerating evaporation in the early stages of filling operation.

When discharged from sphere, liquid chlorine in heat exchange with brine at 0 F. returns about half the refrigeration needed to re-liquefy chlorine vaporized during storage. This warms chlorine enough for handling in conventional storage steels in rest of system.

► **What's Evaporation Rate?**—Theoretical vaporization rate is 4 tons/day of chlorine at atmospheric pressure with continuous venting to maintain equilibrium temperature in chlorine pool. Actual vaporization, however, averaged only 2.5 tons/day last July with 1,700 tons of liquid in sphere.

If tank is filled and isolated with all nozzles closed, chlorine temperature should rise about 1 deg. F. per day in summer. Thus, tank could remain static for about 45 days before popping relief valve.

## New Acrylonitrile Route Has Fewer Process Steps

Standard Oil Co. of Ohio will soon break ground for its multi-million-dollar acrylonitrile plant at Lima, Ohio, and by 1960 will have on stream the first plant to make this chemical from propylene and ammonia.

Already some pilot plant samples of the acrylonitrile so produced have been polymerized, spun into fibers and tested for dyeing and aging, with a high degree of acceptability.

Though Sohio is tight with details, it's known that the process involves catalytic, vapor-phase reactions and is highly selective. Since propylene concentration is not critical, typical refinery propane-propylene streams can be used. Sohio also expects to recover commercial quantities of byproduct acetonitrile and to develop new markets which will absorb it.

## Chemical Progress Week Stresses Industry's Work

The upcoming Chemical Progress Week, April 13-17, will, for the sixth year, serve to remind the public of the chemical industry's contributions to everyday living.

Objective of Chemical Progress Week is a limited version of that of Chemical Industry Activity Committee's program. As last year, Chemical Progress Week is again an optional part of the CIAC year-around effort.

To help in promoting Chemical Progress Week, Manufacturing Chemists' Association is making available such materials as brochures, films and payroll stuffers. Specific advice or assistance may be obtained from MCA national headquarters in Washington, D. C., or from your area or company CIAC chairman.

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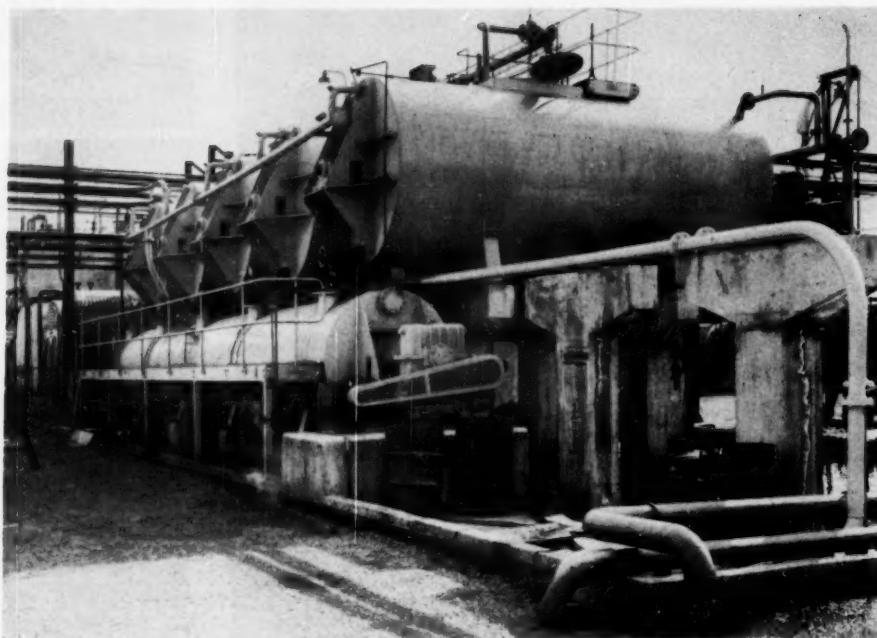
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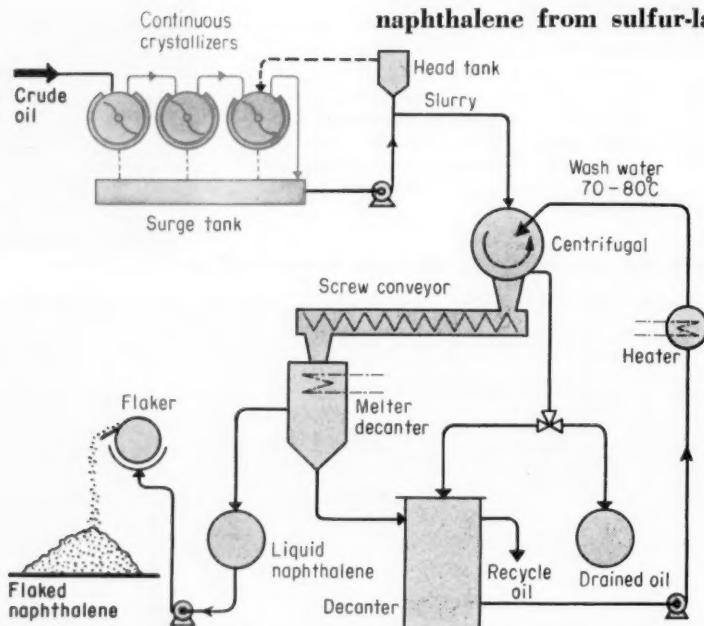
**FANMIX GAS-OIL BURNER**



CONTINUOUS crystallizers convert crude tar distillate to slurry of naphthalene crystals.

## Crystal Fractionation Beats Distillation

Here's a case where continuous crystallization outshone distillation for winning commercial-grade naphthalene from sulfur-laden, crude tar distillate.



Naphthalene refiners in the U. S. are swinging toward vacuum distillation for production of commercial-grade naphthalene directly from crude coal tar distillate. (For recent example, see *Chem. Eng.* Feb. 9, 1959, p. 74.)

But in England, Dorman Long (Chemicals) Ltd. chose continuous crystallization in preference to distillation for recent conversion from batch to continuous processing at its 30 ton/day plant in Port Clarence, Middlesbrough, England. Sulfur compounds in Dorman Long's feedstock stay with naphthalene throughout distillation processing, make use of some other method mandatory.

► **Two Steps**—Using process developed by Proabd (England) Ltd., Dorman Long consistently produces a commercial-grade,



## Improved Processing through Engineered Agitation

### HOW IMPORTANT IS GOOD FLUID MIXING IN YOUR PROCESS?

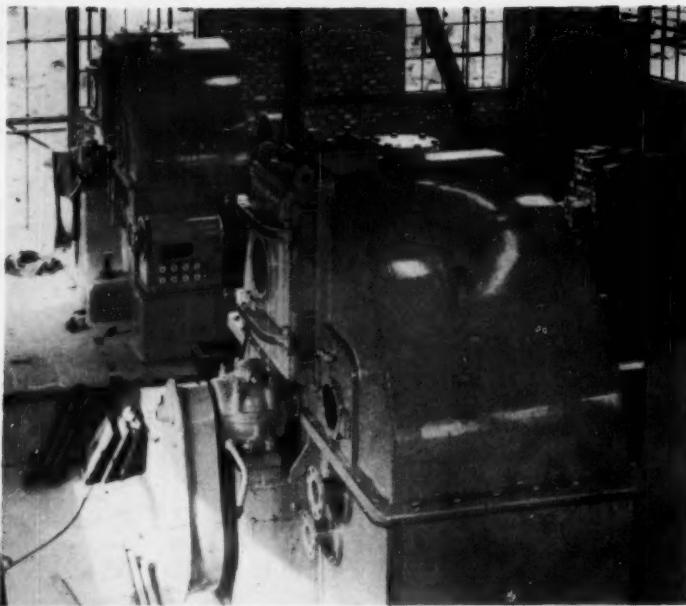
REGARDLESS OF HOW SPECIALIZED your particular processing needs are, good mixing can be the difference between "run of the mill" and maximum yields.

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2. Nettco Flomix® in the continuous recycling of waste product to improve yield.
3. Variable speed pilot plant application of Nettco medium speed, propeller drive mixer.
4. Raw material batch blending with Nettco side drive mixer to assure uniformity.
5. 15 year old Nettco tank top mixer for synthetic rubber production with one of first double mechanical seals.



BASKET centrifugals spin off crude oil, wash crystals with hot water.

78.5-deg. naphthalene (crystallizing point, 78.5 C.). Crystallized continuously from the crude distillate, the naphthalene crystals are separated out as finished product via centrifuging with hot-water washing.

Only previous commercial-scale installation of Proabd process in England at Lancashire Tar Distillers in 1956 did not incorporate continuous crystallization.

► **Matter of Hours**—Freed of extra steps and equipment such as large hydraulic presses used previously, Dorman Long's new setup saves significantly on initial investment and operating costs. Processing, now completed in a matter of hours, used to take two to four days via a batch process.

► **Effective Washing**—Success of the Proabd process is claimed to rest on its ability to produce a slurry of crystals (1) which can be centrifuged, and (2) which then can be washed to desired purity with hot water.

Using a series of crystallizers, process is believed by Proabd to produce localized zones within the liquid which are more concentrated with respect to naphthalene than the mean concentration of the system. Proabd researchers believe that crystals form within these local concentration zones.

While proper crystal formation is vital, Proabd points to its success in using hot wash water as no less important. At temperatures of 70 to 80 C., the wash water reduces oil content of the packed crystals from 10 to 3%. Their crystallizing point, an index of quality level for naphthalene's volume market among manufacturers of phthalic anhydride, goes from 75 C. to a consistent and satisfactory 78.5 C.

► **Problems in Handling**—According to Proabd, once basic process was established, 80% of remaining problems related to materials handling.

Freezing at about 50 C., crude must be handled so that it cools to a slurry rather than a solid mass. Once formed, the heavy crystals will settle out unless suitable precautions are taken. And the semi-granular solids in purified cake will stick to almost anything that they touch. ► **Feed to Crystallizer**—Crude oil with a crystallizing point between 50 and 60 C. feeds into crystallizing vessels which are cooled by water circulating through external jackets. Crystals forming along the internal walls are removed by rotating scrapers.

Arranged in series, the cylindrical horizontal crystallizers provide successively cooler

stages as the slurry passes from one to another.

► **Handling Slurry**—Crude material, now a slurry of crystals suspended in creosote oil, discharges from the last crystallizer to an agitated tank. From tank, slurry circulates continuously through pipe loop to centrifugal separator and back to tank. That way, centrifugal has continuous supply of feed from flow circulating to prevent drop-out in the line.

Care is taken to control slurry consistency so that it remains sufficiently mobile for pumping, yet doesn't become sufficiently fluid to flow at high velocity and damage crystals.

► **Spin Out Oil**—Two centrifugals with baskets 6.58 ft. in diameter running at 760 rpm. separate the crystals from the slurry. They operate on an automatically controlled cycle of charging, spinning, washing, drying and discharging.

During charging and initial spinning, separated liquid discharges to a tank from which it is pumped to creosote oil storage tanks. Wash liquor from the next phase of cycle is diverted to another part of the system. There, naphthalene-rich oil separates from the wash water by decantation.

Decanted water recycles back to centrifugal; oil goes to crude oil storage for recycle back through process. Within water system, a thermostatically controlled heater holds the desired temperature level.

► **Finishing Product**—Naphthalene cake from the centrifugals goes by screw conveyor and bucket elevator to a melting vessel. As naphthalene melts, water is liberated from the crystal interstices and separated by decantation for return to the washing circuit.

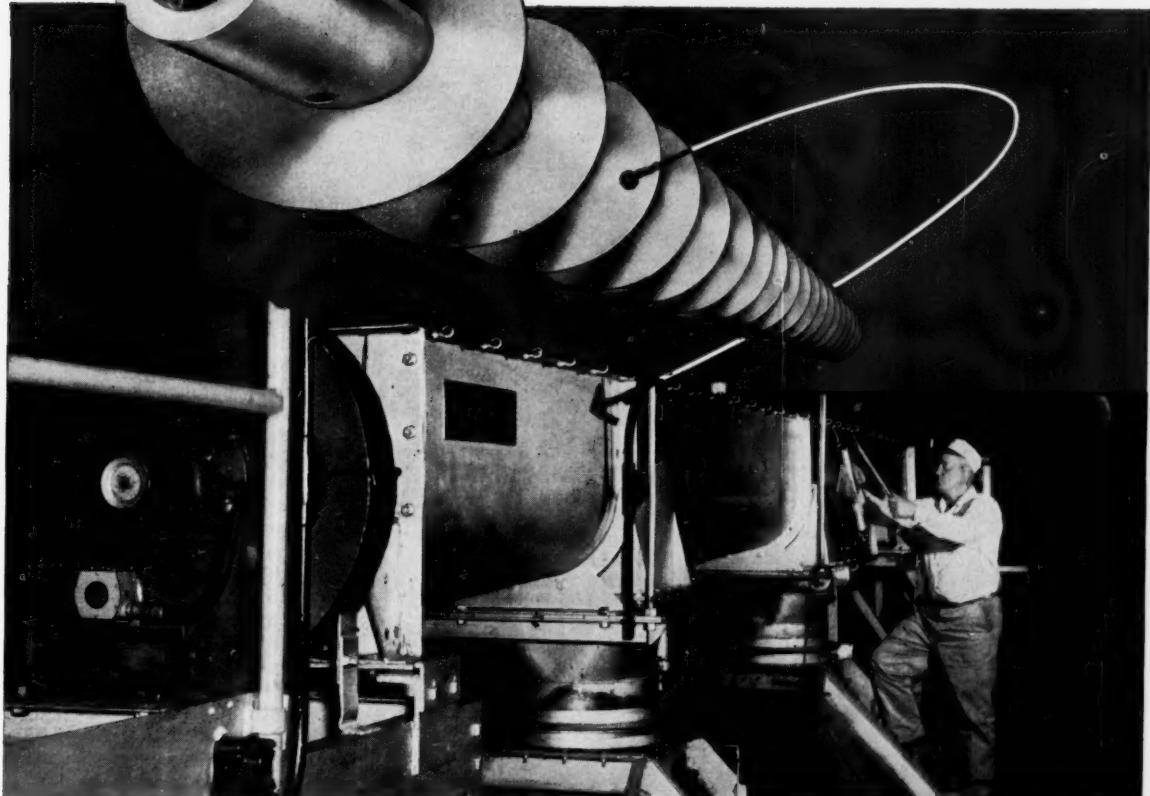
Liquid naphthalene, containing only 0.5% water, discharges to storage tanks. For solid product, liquid is withdrawn from storage by submerged pump feeding flaker. Cake of solid naphthalene forms on surface of water-cooled drum rotating in shallow tank of liquid naphthalene.

Knife bearing against drum scrapes off solid into conveyor which feeds bagging line.

*Here's why a Link-Belt engineered screw conveyor installation means*

# **a better-working system ... less work for you**

- Thorough engineering analysis of all conditions
- Unbiased selection from industry's most complete range of components
- Expert field erection
- Full responsibility for satisfactory performance



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## How Engineers Proved Out Sodium-Water Unit

**It's fact, not fiction.**  
**Heavy water and sodium**  
**can be harnessed into same**  
**nuclear reactor, according**  
**to feasibility studies just**  
**completed for AEC.**

Well established in nuclear reactor technology are sodium coolant and heavy water moderator. Yet, never have they been used within the same reactor system because they create explosive conditions on contact.  
 ▶ **Now Feasible**—Under an AEC contract, Nuclear Development

Corp. of America (NDA), White Plains, N. Y., recently proved the feasibility of using sodium and heavy water in one reactor. Pilot operations by NDA led to preliminary design of the Sodium Deuterium Reactor (SDR), a 10,000-ekw. power reactor, fueled with natural uranium.

Contract for feasibility study came about because of reactor proposal submitted to AEC by Chugach Electric Assn., Anchorage, Alaska. Scheduled for completion by 1963, reactor will serve as pilot unit for larger natural uranium systems.

▶ **Why Use Both**—Moderation of reactor with heavy water results in high neutron economy, thus permits natural-uranium fueling. And sodium cooling results in high-temperature, high heat-flux required for production of superheated steam.

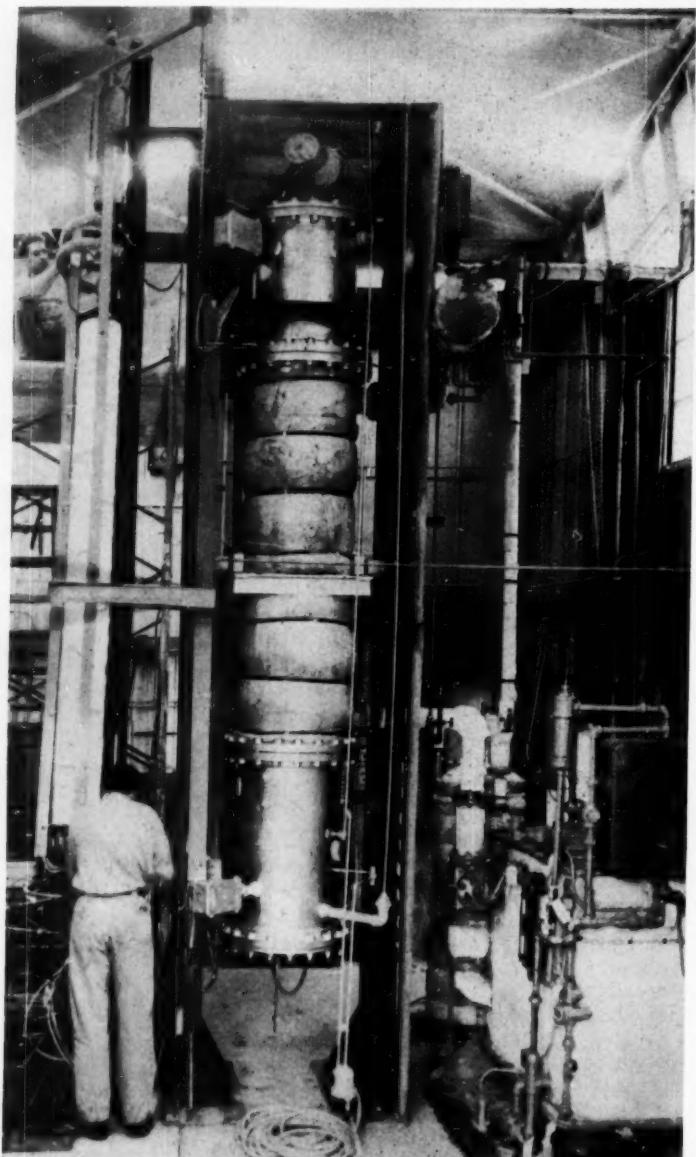
Pilot studies show that SDR design may be upscaled to a 40,000-ekw. reactor fueled with natural uranium to produce super-heated steam at competitive price.

▶ **Segregate the Hazards**—Unique reactor configuration, carefully selected materials of construction and low free-oxygen content of moderator are essential elements in safe concurrent use of sodium and water.

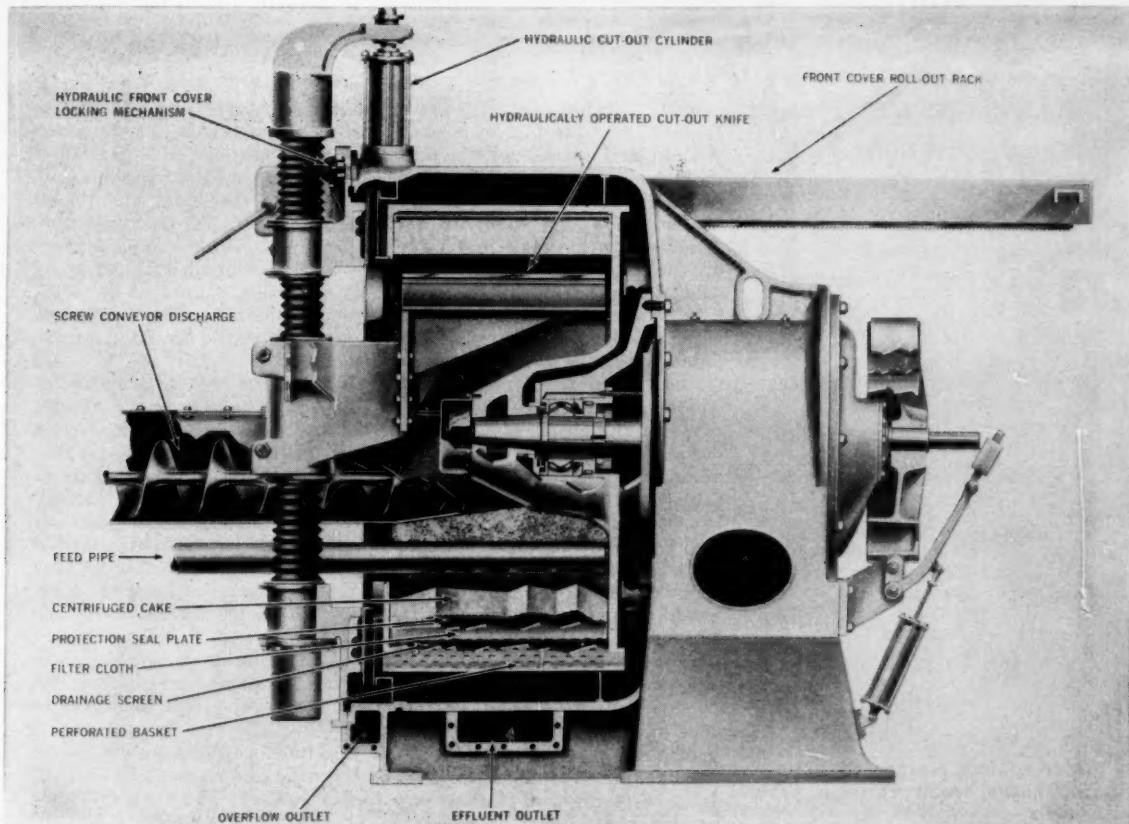
Reactor design isolates heavy water and liquid sodium systems from thermal and chemical interaction. Fail-safe nature of design is expected to cope with any eventualities.

Shell of reactor is a calandria filled with heavy water. Within the shell, tube assemblies hold the natural uranium fuel and serve as flow passages for the sodium coolant.

Each tube assembly consists of three concentric tubes. Inner tube of stainless steel holds natural uranium fuel capsules around which flows sodium coolant. Within external annular spaces formed by the outer two aluminum tubes, helium flows as an efficient insulation against outward flow of heat. Too, it acts as a bar-



**MOCKUP** completes 2,779-hr. trials to prove feasibility of using sodium and heavy water in same natural uranium reactor making superheated steam.



## For Top Performance—it's always REINEVELD

For any given bowl diameter, the Reineveld Centrifugal produces the greatest force field. Its lower product moisture, higher capacity and more economical operation are functions of these higher G's.

The cut-away view clearly illustrates the superior design, highlighted by the patented centrally located main bearing. Note also that cleaning and maintenance of the Reineveld is reduced to a simple, low-cost operation by quick-opening features such as the roll-out of the hydraulically locked front cover.

Precise workmanship and rugged design make it the outstanding new Centrifugal in its field.

### DESIGN DATA OF REINEVELD CENTRIFUGALS

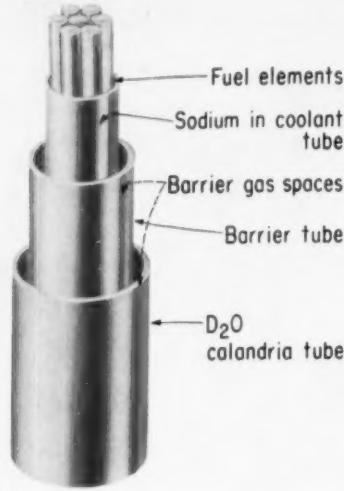
Bowl Diameter	28" S	36"	51"	68"	80"
Bowl Content (cu. ft.)	1.2	4.9	13.2	28.1	43.3
Bowl Content (gallons)	9.0	36.5	99.0	211.0	325.0
Screen Area (sq. ft.)	6.2	13.5	27.4	46.5	65.0
Design RPM	2000	1500	1085	850	750
Equivalent Force (G's)	1560	1140	850	700	625

Consult Heyl & Patterson's listing in CEC or write for Bulletin 356 for Reinevelds, or Bulletin 1157 for H & P Cyclones.

*Heyl & Patterson* INC.

55 FORT PITT BLVD., PITTSBURGH 22, PA., C 1-0750

## Reactor Tube Design Solves Isolation Problem



rier against leakage of sodium or heavy water through tube walls.

► **Chemical Safeguards** — In handling sodium, blanketing with inert gas prevents highly exothermic reaction of sodium with air or hydrogen with oxygen. Free-oxygen content of gas blanket is held below 5% so that only relatively low-heat sodium-water reaction is possible in case of tube failure. Adequate surge and pressure venting volume will take care of shock wave and hydrogen evolution from possible sodium reaction.

► **Proved Feasibility** — Development of the feasibility program advanced through four stages.

First, NDA had to find a commercially available barrier material which would offer low neutron absorption and high resistance to penetration by liquid sodium. Aluminum plate withstood jet impingement from 1,100-F. sodium for 3½ hr. to win selection as safety barrier material. Reactor operating conditions call for maximum sodium temperature of 950 F.

Next, NDA subjected a tube-assembly configuration to reactor failure conditions. Test section simulated a 24-in. length of the multiple-tube SDR as-

sembly. Stainless-steel, fuel-coolant tube was filled with hot sodium and placed within aluminum barrier tube. Simulated calandria held water jacket around tube assembly.

Sodium and water jets were directed against inside and outside surfaces of the barrier tube, concurrently. Only above aluminum's 1,200-F. melting point was the barrier penetrated. Even then, no damage was done to the test section because of the absence of oxygen.

Barrier reliability determined, the next step was to establish manufacturing feasibility of the header assemblies. Weld, tensile and static bending tests simulated deflection effects caused by reactor operational temperature differentials.

► **Operate Mockup** — Chemical engineers at NDA assembled the components that they had proved out into a single assembled mockup of the SDR reactor.

Mockup consists of three, 4-in.-dia. tube assemblies installed in a 8-ft.-high, 2-ft.-dia. calandria. Auxiliary equipment simulates reactor operation. Systems to detect and warn of leakage from either sodium or water zones are like those included in the reactor design.

Proof of successful feasibility trials was total 2,779-hr. operation logged with 950-F. sodium and 150-F. water circulating through system. Even simulated emergency high pressures and temperatures did not cause system failures.

## Float Glass Process Promises Lower Prices

Britain's largest plate glass maker, Pilkington Brothers, Ltd., recently announced development of a "float process" for producing plate glass—which it is claimed will revolutionize glass making. According to the inventors, new process improves plate glass quality while lowering investment and operating costs.

Name "float process" comes from the fact that molten glass is floated on the surface of liquid metal to form perfectly parallel surfaces. Glass gradually hard-

ens free from any distortion since the only forces acting are surface tension and gravity—surface formed is the natural surface of the liquid. Quality of the glass is better than that produced by conventional plate glass grinding techniques. Float glass is now being marketed in "commercial quantities," but firm will not divulge the capacity of its plant.

Details of process are still secret, but this is a general outline of the operation: Raw materials are melted in a conventional furnace. Molten glass flows in a 30-in.-wide ribbon over surface of liquid metal bath, kept at required temperature by external heat. Above the glass are three separate zones: heating zone, fire-polishing zone and cooling zone.

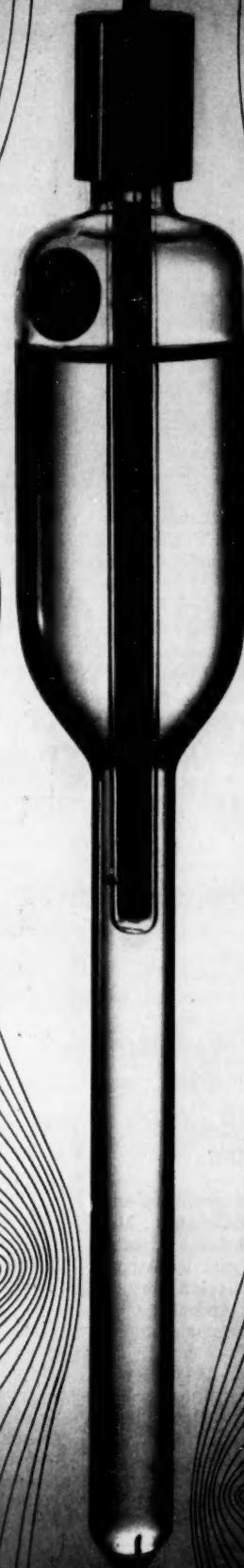
Emerging from cooling zone, glass ribbon passes to a lehr for final annealing and then goes to cutting table; entire operation is continuous. Process was seven years in development at a cost of \$11 million. Firm says it may license process when some of the remaining kinks are ironed out.

## More Polypropylene Scheduled for '59

Entry of Sun Oil and American Viscose into the polypropylene field (*Chem. Eng.*, Mar. 9, 1959, p. 67) brings up to four the number of U.S. firms committed to this new polyolefin: Hercules is already in production at its 20-million-lb./yr. plant at Parlin, N. J.; Humble Oil and Eastman Chemical also plan to go into production.

Sun and American Viscose will own equal shares of the new company—called AviSun Corp.—that is scheduled to be the nation's "largest commercial supplier of polypropylene by mid-summer." Process to be employed was developed by Sun scientists and is not licensed from either Montecatini or Ziegler, says a company spokesman.

Production will start at facilities leased from Koppers' Port Reading, N. J., linear polyethylene plant. One line of the plant, rated at 20 million lb./yr., will be converted to polypropylene pro-



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duction at a cost of \$1 million. Conversion of the polyethylene unit to polypropylene bears mute testimony to the overexpanded state of the linear polyethylene business in the U. S.

Viscose researchers have developed new processes for making polypropylene fiber and film. Firm will add film and fiber production units to its Marcus Hook, Pa., plant—all under AviSun management. Cost of these new units is estimated at "several million dollars." Sun will supply concentrated olefin raw material to the Port Reading plant by truck and tank car from its Marcus Hook refinery.

### Opponents Decry Plan For Plowshare A-Blast

Soon after the Dallas, Tex., meeting last January where the Bureau of Mines and Atomic Energy Commission presented their proposal to industry for use of an A-bomb to tap the Colorado shale oil reserves, critics of the plan began voicing loud disapproval. Opposition hinges on two factors: public safety and uncertainty of results.

Rep. Daniel J. Flood (D., Pa.) calls the plan "scientific hoax of the century" and claims that the Bureau did not investigate safety aspects of the blast. Moreover, Flood charges, AEC Chairman McCone has admitted that the \$3-million blast would probably not produce any oil.

Adding his voice to the uproar, Morgan G. Huntington, president of the RNB Corp., Salt Lake City, charged that the blast would create a huge crater instead of oil, scattering radioactive rock over a wide area. The whole Bureau of Mines study, he says, does not measure up to its usual high standards of public safety.

Another cautious note was sounded by R. S. Herbst of Lawrence Radiation Laboratory speaking before the National Western Mining Conference in Denver. Herbst said the earliest possible date for the blast would be sometime in 1960 and added that "word to go ahead can't be given until everyone concerned—government, private industry

and public safety officials—agree that the test should be made."

### Powder Techniques Make Ceramic Nuclear Fuels

Atomic Energy Commission is now at an advanced stage in a program at its Hanford Works, Richland, Wash., aimed at raising the temperature limits on nuclear fuel elements.

Using powder-metallurgy techniques, General Electric scientists at the Hanford laboratories are producing ceramic fuel elements that can withstand temperatures up to 5,000 F. Elements using natural or enriched uranium begin to melt if temperature climbs above 1,500 F.

At Hanford, uranium-dioxide powder is first machine-ground into fine  $UO_2$  particles, and lubricant is added to hold it together. The mixture is cast in a 50-ton press into various forms, most commonly resembling a heavy bracelet. Then the bracelets are sealed in a rubber covering (ordinary latex-rubber gloves are used) and placed in a hydrostatic press under pressures up to 50,000 psi. Finally, ceramic sections are sintered in a hydrogen atmosphere at a temperature of about 3,200 F.

Various fuel element prototypes (including ceramics) will be tested in the plutonium recycle test reactor now under construction at Hanford (*Chem. Eng.*, Sept. 22, 1958, pp. 82-84).

### NEWS BRIEFS

**Modular nuclear power plant:** Martin Co., Baltimore, Md., has been awarded an estimated \$6-million contract by Atomic Energy Commission to design, construct and test operate a factory-assembled modular nuclear power plant. Tab for the cost-plus-fixed-fee contract will be picked up by AEC and the air force. Power plant will be designed as factory-assembled modules or units which can be air transported and rapidly connected. Plant will have pressurized-water reactor, fueled with enriched uranium, and will supply

2,000 kw. of heat and 1,000 kw. of electricity.

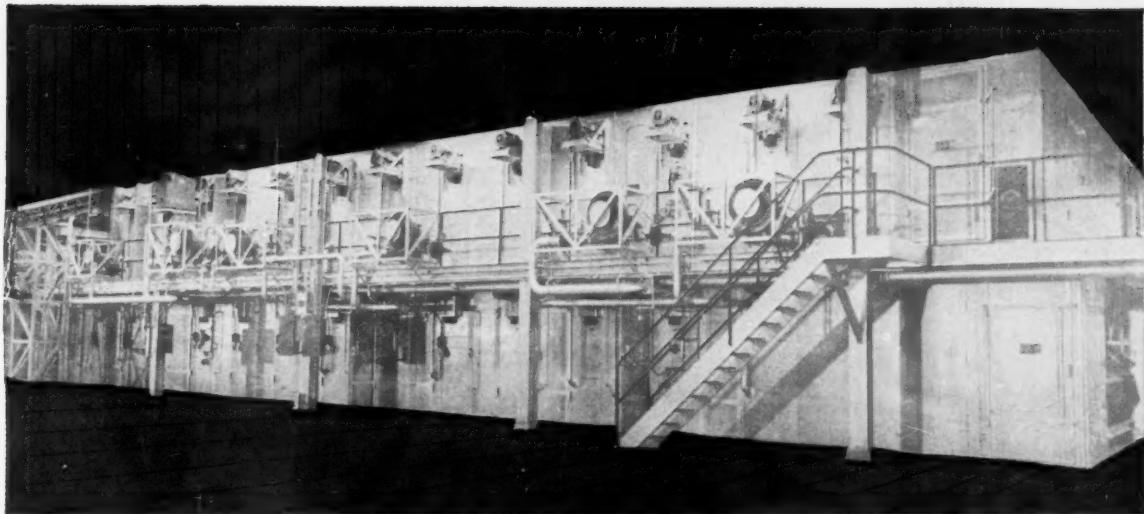
**Permeation process:** Ionics, Inc., Cambridge, Mass., now has exclusive rights to commercialize American Oil Co.'s new membrane permeation process (*Chem. Eng.*, June 2, 1958, p. 50). Amoco process causes one of the components of a mixture to dissolve in the membrane and move through it to the other side.

**Crude distillation unit:** Shell has added an \$18.2-million, 80,000-bbl./day Mideast crude distillation unit at its Shell Haven, England, refinery. A high degree of heat recovery cuts fuel consumption about 30%. Large high-speed centrifugal compressor routes all uncondensed streams to gas-fractionating columns, gets good recovery of light hydrocarbons.

**Process dynamics:** National Science Foundation has awarded a grant of \$20,000 to Case Institute of Technology, Cleveland, Ohio, to support an experimental summer conference which will expose 30 professors of chemical engineering to theory and techniques of process control dynamics. This year, the three-week conference will be July 6-24.

**"H-iron" plant:** Bethlehem Pacific Coast Steel Corp. has broken ground for a pilot H-iron plant at its Los Angeles, Calif., plant. Engineered by Hydrocarbon Research, the outdoor pilot plant will produce small quantities of crude iron via a direct reduction process that uses hydrogen at relatively low temperatures and high pressures.

**High-pressure tank:** Linde Co. has designed and built a 10-ton high-pressure liquid nitrogen tank and pumping unit for use in Atlas intercontinental ballistic missile program on the West Coast. Unit comprises a 500-gal. insulated liquid nitrogen tank, a pumping system capable of building up pressure to 13,000 psi, mounted on trailer.



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## Depreciation Allowances Ease Profit Erosion

	Profits After Taxes		% Change (1957-58)	
	% of Sales		Without Depreciation	With Depreciation
	1957	1958		
<b>Chemicals</b>	7.6	7.0	- 9	- 4
Industrial	9.5	7.9	- 20	- 10
<b>Drugs &amp; Medicines</b>	10.4	9.5	+ 7	+ 7
Petroleum Refining	10.6	9.2	- 17	- 10
Paper	5.0	4.4	- 13	- 5
Rubber	4.2	4.0	- 7	- 3
Stone, Clay & Glass	7.5	7.5	- 2	+ 2

## Battered Chemical Profits Will Rally in '59

William H. Chartener, McGraw-Hill Dept. of Economics

The business recession slashed deeply into chemical profits in 1958. But a strong resurgence of sales and broad improvements in the general business outlook during the tail end of the year promise much brighter financial reports this year.

Chemical industry economists expect sales of chemicals and allied products in 1959 to run about 8% higher than in 1958—with industrial chemicals up about 10%. Higher sales, increased productivity, and firm, or slightly higher, prices should together bring about a rise in profits of as much as 20%.

Because the recession hit bottom during the early months of the year, the rebound brought total chemical sales about even with 1957. Profits fared worse—dropping about 9%—as rising costs squeezed margins. Chemical prices were virtually unchanged through the recession and—according to the Bureau of Labor Statistics—were actually slightly lower at the end of 1958 than a year earlier.

Compared with other manu-

facturing industries, however, the chemical industry—and most other process industries—did relatively well. Their sales and profits didn't fall as sharply, and they snapped back sooner. By September 1958, chemical producers' sales already had passed their prerecession peak. ►“Cash Profits” Brighter—The 1958 showing of the chemical process industries was much better in terms of “cash profits”—aftertax profits plus depreciation—than is indicated by the straight profit figures. Depreciation allowances, which are free from tax, rose anywhere from 1%, in the case of petroleum refining, to 10% in the stone, clay and glass group.

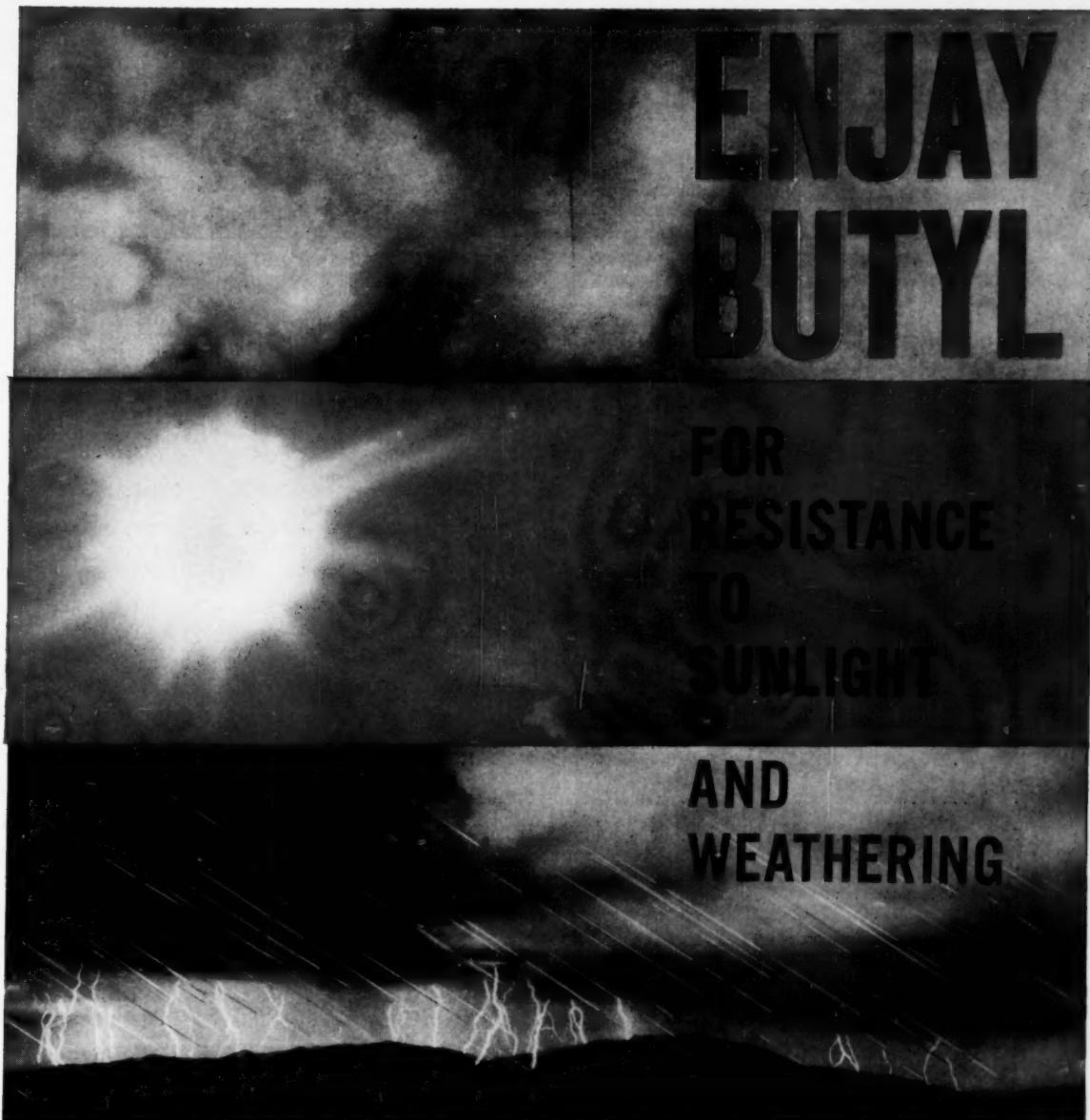
The percent drop in cash profits was less than half the drop in aftertax profits in the chemical, paper and rubber industries. And in stone, clay and glass, there was an increase of about 2% in cash profits, against a drop of about 2% in straight posttax profits (see chart above). ►Other Good Signs—Two other balance-sheet items indicate that

the chemical industry and other process industries are in better financial shape than they were late in 1957, when the economy was heading into the recession.

Net working capital was higher by 2%, in the case of chemicals, to 10%, in stone, clay and glass, at the end of the third quarter in 1958 compared with the same period in 1957. Also, year-end inventories were down and in much better relationship to sales levels.

Within the chemical industry, the drug manufacturers did especially well and managed generally to chalk up pluses in both sales and profits. Major diversified chemical producers were down somewhat for the year as a whole, but fourth-quarter results were favorable.

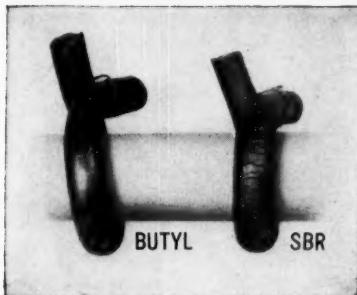
Du Pont reported its fourth quarter last year was the highest quarter for the company in three years. Dow Chemical, which reports on a fiscal year ending May 31, expects its current (1959) fiscal year to set a new record in sales and rank second only to 1956 in earnings per share.



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CHEMICAL ENGINEERING—April 6, 1959

## Most Chemical Profits Got the Axe in '58

	Sales (Thousand Dollars)		% Change 1958/1957	Profits (Thousand Dollars)		
	1957	1958		Sales	Profits	
Air Reduction	189,988	175,308	- 7.7	- 19.0	16,476	13,350
Allied Chemical	683,079	635,532	- 7.0	- 22.1	43,398	33,819
American Cyanamid	532,479	525,076	- 1.4	- 14.6	51,348	43,841
Diamond Alkali	122,638	114,200	- 6.9	- 8.0	7,035	6,475
Dow Chemical <sup>1</sup>	337,203	341,881	+ 1.4	- 3.2	28,957	28,029
Du Pont	1,964,624	1,825,000 <sup>2</sup>	- 7.1	- 14.5	396,610	339,102
Food Machinery & Chemical	313,925	315,300 <sup>3</sup>	+ 0.4	+ 2.5	15,895	16,300
Hercules Powder	245,265	236,513	- 3.6	- 3.4	18,116	17,509
Hooker Chemical <sup>4</sup>	129,269	126,325	- 2.3	- 4.9	11,184	10,639
International Minerals & Chemical	43,843	43,655	- 0.4	- 50.1	575	287
Koppers	326,340	260,600	- 20.1	- 30.1	9,449	6,609
Monsanto Chemical	567,116	547,956	- 3.4	- 7.7	37,416	34,550
Olin Mathieson	592,877	601,398	+ 1.0	- 74.0	36,377	9,383
Stauffer Chemical	156,900	159,500	+ 1.7	+ 11.0	13,101	14,546
Union Carbide	1,395,033	1,296,532	- 7.1	- 6.6	133,741	124,937
Abbott Laboratories	111,271	116,598	+ 4.8	+ 1.5	12,681	12,873
American Marietta <sup>5</sup>	234,038	251,417	+ 7.4	+ 2.3	17,183	17,581
Atlantic Refining	565,946	538,110	- 5.0	- 5.3	35,670	33,825
Crown Zellerbach	460,609	468,813	+ 1.8	- 2.9	34,229	33,234
Devoe & Raynolds	56,666	53,478	- 5.6	- 40.4	2,027	1,208
General Portland Cement	37,763	46,906	+ 24.2	+ 29.0	6,983	9,011
Goodyear Tire & Rubber	1,421,850	1,367,576	- 3.8	+ 1.4	64,826	65,741
Merck <sup>6</sup>	181,302	202,311	+ 11.6	+ 18.7	22,371	26,560
Owens-Illinois Glass	510,487	508,460	- 0.4	+ 5.5	35,810	37,772
Pfizer	207,152	222,726	+ 7.5	+ 4.6	22,909	23,965
St. Regis Paper	376,800	376,600	0	- 3.7	21,800	21,000
Scott Paper	275,006	285,000	+ 3.6	+ 2.0	21,560	22,000
Standard Oil (New Jersey)	7,978,000	7,705,000	- 3.4	- 29.9	805,000	564,000
Sun Oil	778,719	724,032	- 7.1	- 32.4	47,492	32,061
U. S. Rubber	873,583	870,615	- 0.3	- 23.7	29,695	22,671

<sup>1</sup> 6 mo. ended Nov. 30; <sup>2</sup> estimated; <sup>3</sup> For fiscal year ended Nov. 30; <sup>4</sup> For fiscal year ended Sept. 30.

► **Productivity Payoff**—Working in chemical manufacturers' favor during the current business recovery is an impressive gain in productivity. The industry is beginning to cash in on the gains in efficiency from new facilities installed in recent years.

Chemical production in December 1958 was running about 7% ahead of the same month the year before—yet employment was 2% less, and production manhours were down 4%.

The 1958 sales and profits pictures in the various process industries—as reflected in the reports of the Federal Trade Commission and Securities and Exchange Commission—shape up this way:

**Chemicals and Allied Products**—Sales held just about even with

1957's total of \$23,427 million. Profits before taxes were off almost 10%, from \$3,379 million in 1957. And profits after taxes were down about 9%, from \$1,792 million.

**Industrial Chemicals**—Sales were down about 5% from the 1957 figure of \$10,178 million. Profits fell a little over 20% from the pretax total of \$1,776 million, and the posttax total of \$966 million.

**Drugs and Medicines**—Sales were up about 7%, from \$3,165 million. Profits, which had run \$662 million (pretax) and \$330 million (posttax), also were up 6-7%.

**Petroleum Refining**—Sales were down about 4%, from \$27,126 million in 1957. Profits before taxes dropped 20%, from

\$3,297 million. Profits after taxes fell about 17%, from \$2,866 million.

**Paper and Allied Products**—Sales dropped slightly, about 1%, from \$10,420 million in 1957. Profits were down 12% or 13% from \$1,020 million (pretax) and \$521 million (posttax).

**Rubber Products**—Sales in 1958 were about 1% under the 1957 total of \$6,406 million. Profits were off a little more: 2% from the 1957 pretax figure of \$525 million, 6% from the aftertax figure of \$271 million chalked up in 1957.

**Stone, Clay and Glass Products**—Also a sales drop of about 1%, from \$8,328 million in 1957. Profits were off 2-3% from \$1,156 million (pretax) and \$619 million (posttax).

# NEW YALE AIR HOISTS PROTECT AGAINST EXPLOSION

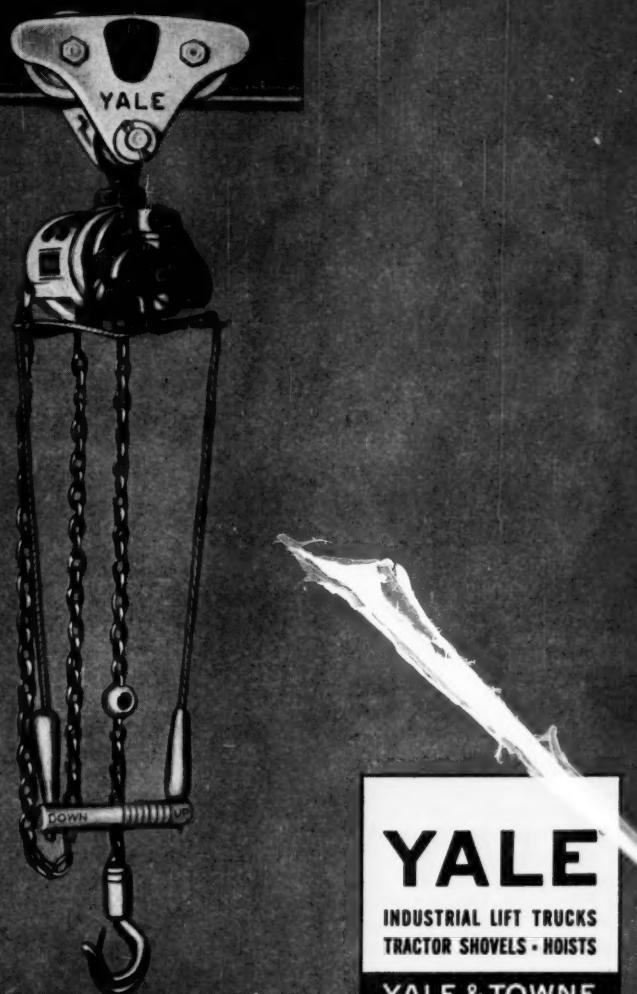
The new Yale Air Hoists provide the margin of safety you need for overhead handling in a hazardous atmosphere. Air motor is explosion-proof—will not overheat—ideal safety factors for chemical plant operations.

Danger of spillage and product damage is lessened, too—constant variable speed control provides smoother lifting and lowering factors. These light, compact hoists—with instant-acting, heavy-duty brake—provide almost silent operation. Motor cannot burn out from overloads or high

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Capacities:  $\frac{1}{4}$  to 1 ton—hook or trolley models—roller or link chain—pendant or pull-cable control. For complete information, contact your Yale distributor listed under "hoists" in the yellow pages of your phone book. Or write for brochure #5145 to The Yale & Towne Manufacturing Company, Yale Materials Handling Division, Dept. AH3-V, Philadelphia 15, Pennsylvania.

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DEVELOPMENTS ...

## CHEMICAL PRODUCTS EDITED BY FRANCES ARNE



### Rubber Sealant Shields Concrete From Salt, Dripping

First application in the East of a new protector for road concrete is shown being made above by the New York State Thruway Authority.

Sealant material, a mixture of rubber, resin and solvent can be applied directly to concrete

paving with a squeegee. Called Rub-R-Road, it is mixed in 2 to 1 proportions with an abrasive aggregate. Product has an adhesive quality which retains non-skid surfaces on pavements.—Firestone Tire & Rubber Co., Akron, Ohio. 94A

### Urethane Rubber

Properties should put it into competition with butyl, neoprene.

Extremely high tensile strength at high ultimate elongation, excellent solvent resistance (particularly to gasoline), low air permeability and outstanding abrasion resistance are among the properties of a new elastomer. Called Estane VC, it is a thermoplastic poly-

mer, linear and not cross-linked, of a polyester and an isocyanate.

The new material, now produced in a semi-works plant at Avon Lake, Ohio, is available in the form of tough, rubbery clear amber granules. These may be converted by milling, calendering, extrusion or molding.

Its properties suggest that it will offer competition to butyl and neoprene rubbers. Compared to neoprene, for example, Estane VC has been tested to

show five times as much abrasion resistance, 50% greater cut resistance, three times the tensile and better aging and low temperature resistance.

First major application is expected in wire and cable jacketing. Other potential uses include: fuel hose, small-bore tubing. Clinical tests of its use as an artificial heart are also under way.—B. F. Goodrich Chemical Co., Cleveland, Ohio.

94B

### Adhesive

Epoxy-polyamide compound now available for all-purpose repair jobs.

Development of a compound that is simple and chemically non-critical has made the unusual adhesive properties of epoxy-polyamides available for common industrial applications.

Supplied in two-can kits containing the epoxy resin and the polyamide hardener, adhesive is a 50/50 mix. Hardener is an amine bearing polyamide known as Versamid, produced by General Mills.

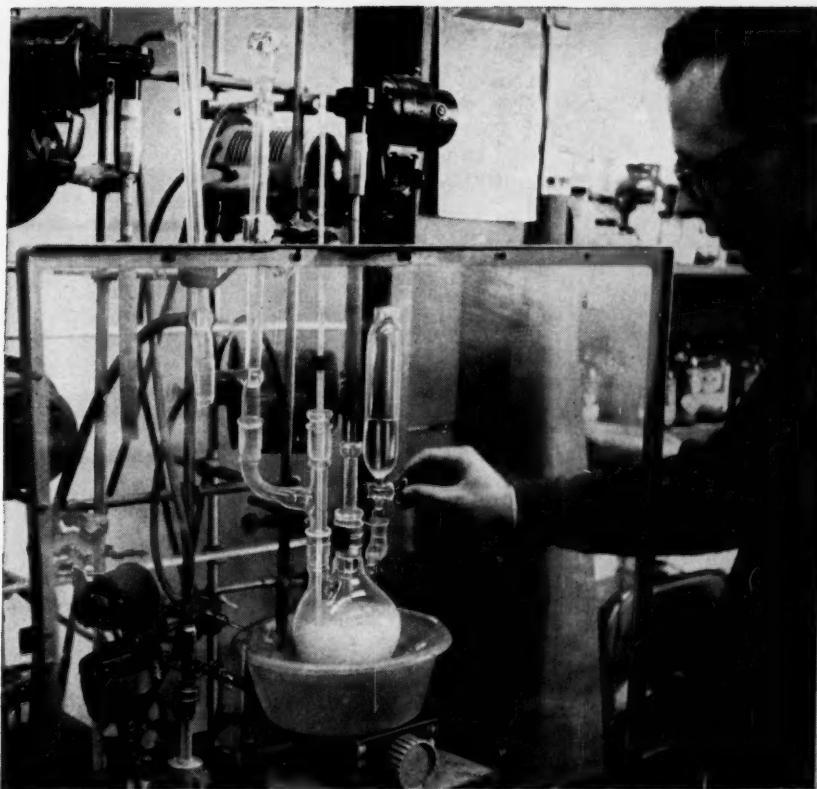
When these two resins, called Plastic Mastic, are mixed, a chemical reaction forms a tough, hard material. Finished product is a thermoset. There are no volatile solvents involved, no fire hazard, no evaporation, no shrinkage after curing.

	Plastic	Mastic	Concrete
Rockwell hardness			
M scale.....	71	64	
Shrinkage, in./in. ....	.001	0.0012	
Compressive strength, psi.			
3 days.....	6,610	3,110	
28 days.....	8,270	3,730	
Abrasion resistance,			
loss/1,500 cycles, in. ....	0.0085	0.0255	
Tensile strength, lb./in. <sup>2</sup> ....	1,480	450	
Adhesion to steel, lb./in. <sup>2</sup> ....	1,260	Breaks	

At temperatures of 70 to 100 F., the product becomes hard in 3 to 6 hr. At lower temperatures, the reaction requires up to 24 hr.; below 40 F., curing is very slow. It can be cured in as little as 5 to 10 min. by the application of heat.—Williamson Adhesives, Inc., 8220 Kimball Ave., Skokie, Ill. 94C

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- "Reduction of Cleavage in Epoxidation Reactions." HP-20
- See attached letter on my problem.

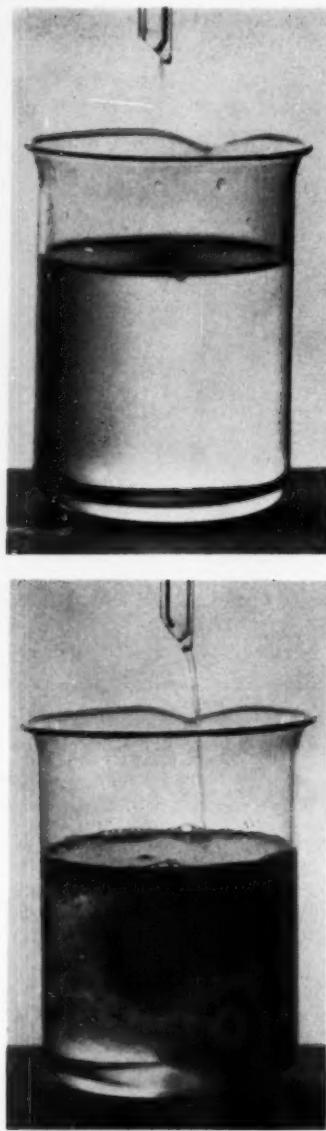
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The new product is a sulfonated alkyl-diphenyl oxide, an anionic surfactant with unusual solubility and stability properties for use: As an additive to reduce viscosity of slurries, as an additive to promote chemical reaction where wetting out is important, as in the manufacture of alkali cellulose, as a coupling agent for organic materials in water.

The diphenyl oxide grouping is unique in that it results in a very stable material. It is very soluble in water, and at room temperature, 50% solutions can be prepared. At 77 F., it is soluble and stable at 0.1% concentration in nearly all 20% aqueous solutions of inorganic compounds. In some systems, as much as 20% or more Dowfax 2A1 dissolves to provide clear solutions. Dowfax 2A1 is also soluble in organic acid and organic salt solutions.—Dow Chemical, Midland, Mich. 96A

### Transparent Acrylic

Boasts exceptionally high heat resistance.

A new transparent acrylic-type thermoplastic polymer for injection molding and extrusion has a heat distortion temperature of 250 F. Its mechanical and optical properties are similar to

those of polymethyl methacrylate, but its heat distortion temperature is 50 F. higher. Called PL-11, it may be immersed indefinitely in boiling water without affecting its water-white transparency.

Industries in which it will probably find application include automotive, aircraft, optical.—J. T. Baker Chemical Co., Phillipsburg, N. J. 96B

### Polyurea Compounds

Water soluble compounds for antistatics and pharmaceuticals.

A new class of polyurea compounds is soluble in water and forms solutions of high viscosity even in concentrations as low as 1%.

They are the result of reacting phenylcarbamides of diamino sulfonic acids or diamino carbonic acids with organic diamines. The large number of diamines which may be used for the reaction allows a variation of solubility and of other physical constants of the compounds according to the requirements.

The new polyureas are expected to find use as antistatics and for the production of drugs.—Farbenfabriken Bayer, Leverkusen, Germany. 96C

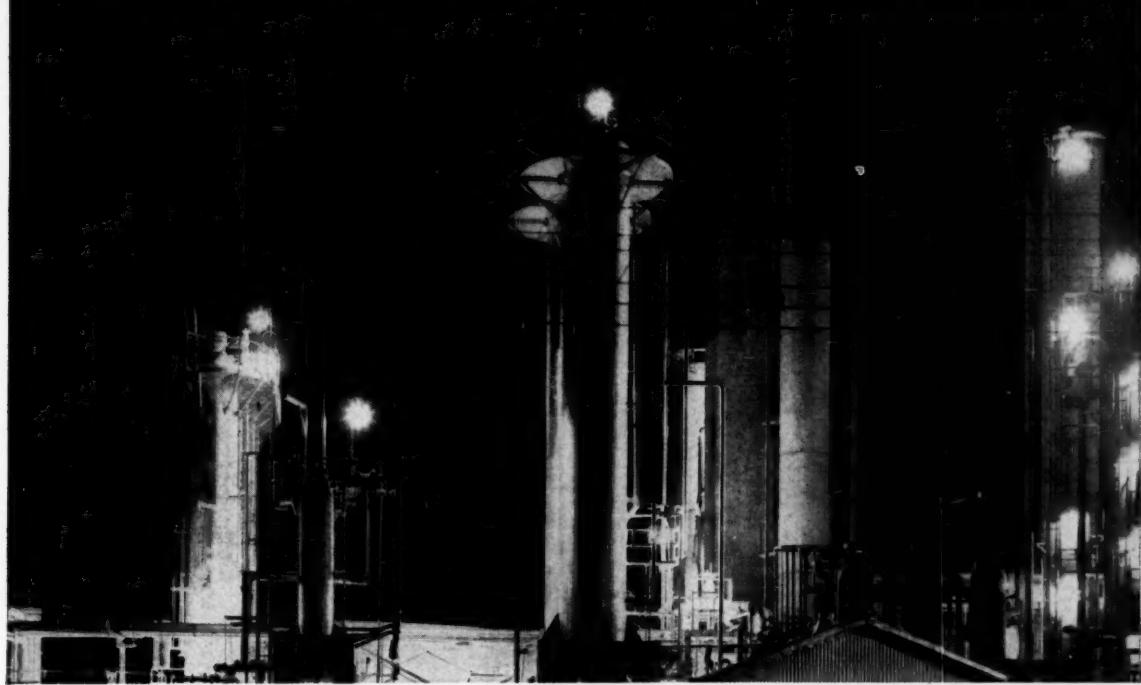
### Newsorthy Chemicals

Page Number is also  
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Rubber sealant shields concrete from salt, drippage . . . . .	94A
Urethane rubber aims at butyl, neoprene markets . . . . .	94B
Epoxy super-adhesive enters all-purpose repair field . . . . .	94C
Surfactant boasts unusual solubility . . . . .	96A
Transparent acrylic stands 50 F. more heat . . . . .	96B
New class of polyureas for antistatics, drugs . . . . .	96C
Non-woven rayon-cotton for industrial wiping . . . . .	98A
Synthetic felt for filters stands chemicals at 400 F. . . . .	98B
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## MHI CALCIUM HYDRIDE dries materials completely in gas or liquid phase

Versatility, almost unlimited . . . effectiveness, process proved . . . MHI calcium hydride is simplifying today's "tough nut" complete drying problems! MHI calcium hydride is uniquely successful in those new processes where water *can't be tolerated*. Included are catalysis systems for polymerization, the preparation of refrigerants, aerosol propellants, pharmaceuticals, and nuclear reactor atmospheres. MHI calcium hydride has an unequaled ability to dry *completely* in unit processes involving gases, such as hydrogen, argon, helium, nitrogen, hydrocarbons, chlorinated hydrocarbons, esters, alcohols, and many other types of compounds.

**HERE'S HOW IT SIMPLIFIES.** Even at elevated temperatures where adsorptive type driers are ineffective, MHI calcium hydride dries completely. Contact with MHI calcium hydride can be in

stirred tanks, by percolation through a fixed bed of calcium hydride, or vapor phase through a fixed bed. Temperatures can range from below room temperature *up to 1400°F*. Contact times may be as short as a few seconds. Calcium hydride is safe and easy to use and store.

**EFFECTIVENESS OF CALCIUM HYDRIDE FOR YOUR PROCESS EASILY PROVED.** With your own titrimeter, you will see how MHI calcium hydride dries residual moisture down to dew points of less than  $-60^{\circ}\text{F}$  or to one p.p.m. range. Metal Hydrides Incorporated will gladly provide samples upon written request.

**NEW CALCIUM HYDRIDE TECHNICAL BULLETIN AVAILABLE.** You may get details on complete drying with MHI calcium hydride by requesting your copy of this new bulletin.

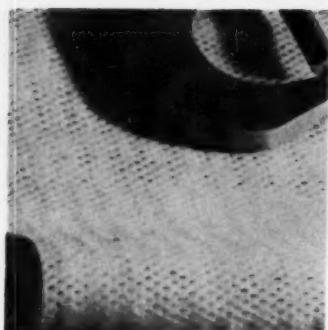


PIONEERS IN HYDROGEN COMPOUNDS

**Metal Hydrides Incorporated**

CHEMICAL HYDRIDE DIVISION

CONGRESS STREET, BEVERLY, MASSACHUSETTS



### Non-Woven Fabrics

For industrial wiping, rayon-cotton toweling, top; for filtering, chemical, heat-stable synthetic felt.

Two new products of non-woven fabric indicate the broad span of markets and properties these fabrics have encompassed in a relatively short time. A blend of 75% Avisco rayon and 25% cotton has been made up into a toweling—sometimes reusable, always economically disposable—for light industrial use. Another fabric of all-synthetic composition—may be all-Dacron, all-Orlon or other synthetic fibers—has been widely tested as a filter and found chemically stable at temperatures as high as 400 F.

► **For Wiping**—The nonwoven toweling moves into markets previously using baled rags, rented linens and paper wipers. Characterized by quick pickup, excellent liquid retention and freedom from lint, it is said to be unusually absorbent and strong.—**American Viscose Corp., Philadelphia, Pa.** 98A

► **For Filtering**—Outstanding characteristics of the new synthetic felt, called Troyfelt, are credited to the fact that it is made by mechanical interlocking of the fibers rather than a chemical binding agent or a supporting fabric.

Besides possessing all the normal characteristics of natural fiber felts, it is said to excel them as follows:

It has higher strength—up to 1,500 psi., depending upon the fiber from which it is made. It has greater dimensional stability in the presence of high temperatures and may be used continually at 400 F.

Troyfelt gives longer wear and better resistance to abrasion than natural fiber felts and is resistant to most acid and alkalies. It is not effected by moisture and will not support rot, mildew or the growth of bacteria. Different fibers, and combinations of fibers, can be used to produce a felt "custom-designed" to meet a specific need.

As for future markets, the manufacturers feel that Troyfelt can be used in any industrial application where ordinary natural fiber or other synthetic felts are now being used.—**Troy Blanket Mills, N. Y.** 98B

### Styrene-Acrylonitrile

Color is clearer than older styrene-acrylonitrile copolymers.

According to laboratory studies and pilot plant operations, a new styrene-acrylonitrile copolymer overcomes one of the difficulties that has attended production of acrylonitrile copolymer in the past: discoloration of the final material. An almost crystal clear product, it requires minimum use of dyes to counteract the slight yellowing of the material encountered in processing.

It is expected to find wide acceptance for such products as tumblers, dinnerware, pen and pencil barrels, food containers, fan blades and air conditioners.

Initial production capacity of the material, called Fostacryl, is between 4 and 6 million

lb./yr. Sales will begin in about six months.—**Foster Grant Co., Leominster, Mass.** 98C

### BRIEFS

**Anti-rads**, chemical materials added to rubber stocks before vulcanization to improve rubber's resistance to radiation damage, have been developed and tested in aircraft tires proving that they can double tire's life in radiation service.—**B. F. Goodrich Co., Akron, Ohio.** 98D

**Secondary plasticizer** for PVC resins, called Conoco H-35, is said to be of uniform high quality, water-white, odorless, easy-to-handle and economical.—**Continental Oil Co., P. O. Box 2197, Houston, Tex.** 98E

**Pyromellitic acid** and pyromellitic dianhydride, which form stable compounds to provide outstanding thermal stability and improved electrical properties for certain uses in the plastics and lubricant fields, will shortly be made in commercial quantities.—**Du Pont Co., Wilmington, Del.** 98F

**Microbiological control** for the pulp and paper industry is more effectively handled by Dioxicide, an aqueous solution of chlorine dioxide. For control of pink slime, it excels metal salts because they are unable to permeate all cell structures and has a lower range of activity. Dioxicide, completely soluble in water, is able to pass through cell walls of all microorganisms.—**Chemical Research Laboratories of America, Providence, R. I.** 98G

### For More Information . . .

about any item in this department, circle its code number on the

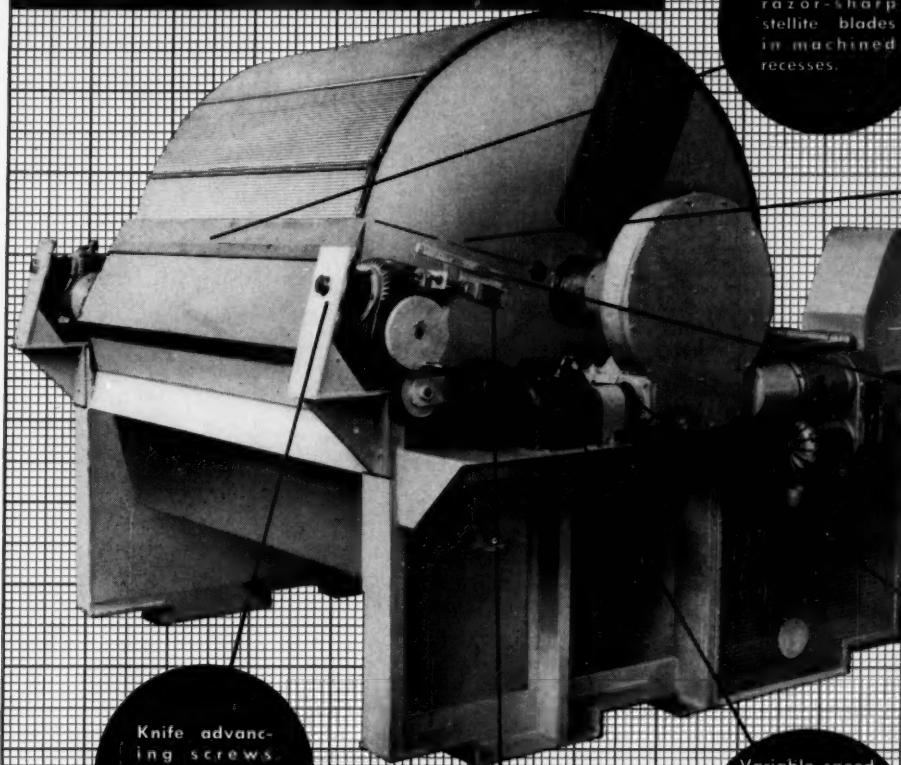
### Reader Service

postcard (p. 201)

FROM KOMLINE-SANDERSON...

NEW  
PRECOAT

Now — a precoat filter that embodies  
ALL of these proved features:



Knife advancing screws rigidly supported at both ends.

Heavy duty explosion proof limit switch to prevent knife from advancing into drum.

Replaceable razor-sharp stellite blades in machined recesses.

Radial knife travel for optimum shaving efficiency and maximum knife edge life.

Clearly marked, conveniently located precoat cake thickness gauge.

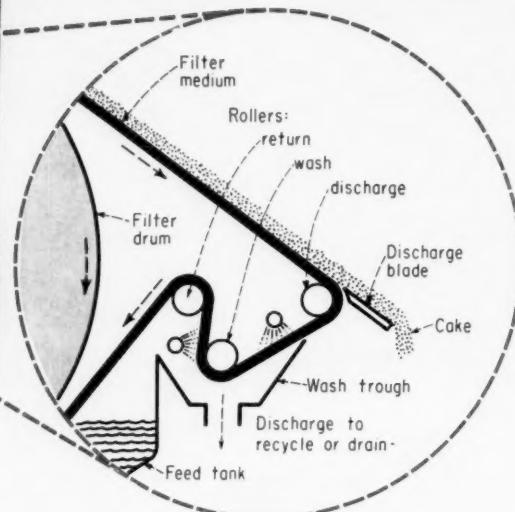
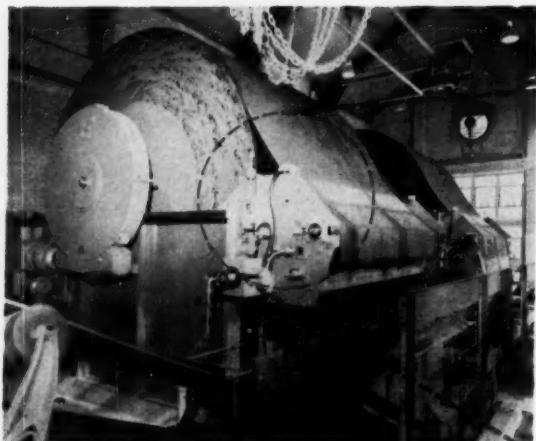
Take-off from drum drive synchronizing drum and precoat knife advance mechanism.

Variable speed knife advance transmission — advance infinitely variable from .00 to .020 per drum revolution.

STRING DISCHARGE  
SCRAPER DISCHARGE  
ROLL DISCHARGE  
PRECOAT  
HORIZONTAL  
LABORATORY TYPE  
PILOT PLANT TYPE  
Write for Bulletin No. KSI-3

INDUSTRIAL FILTER DIVISION  
KOMLINE-SANDERSON  
ENGINEERING CORPORATION  
PEAPACK, NEW JERSEY

Complete filtration testing facilities available.



Cloth-medium Rotabelts are now available for more diverse applications. Using wire-mesh media, initial units proved successful in sewage-treatment plants.

## Moving-Medium Filter Heads for Chemicals

When solid particles become imbedded in the pores of media on rotary vacuum filters, operation efficiencies fall off. Eimco Corp. has come up with a machine that eliminates this long-standing problem of media blinding, while maintaining high filtration rates, low cake moistures and good filtrate clarities.

► **How It Works**—Called the Rotabelt filter, the machine does not use a medium that is fixed to the drum's surface by means of caulking. Instead, the medium is an endless belt that temporarily leaves the drum's surface to pass over several rollers.

One of the rollers acts as a cake-discharge mechanism. Undischarged filter cake tends to

follow a path tangent to the point of contact between the medium and this roller. In so doing, the cake breaks cleanly away. A discharge blade that fits between cake and medium aids this action; however, the blade never actually contacts the medium.

As the medium passes over another roller, it is thoroughly washed on both sides—this ends blinding problems. All wash liquid falls into a receiving trough. A final roller guides the medium back onto the drum.

► **Many Claimed Advantages**—Main advantage of the machine, says Eimco, is that it can handle many filtering jobs that cannot be handled by conventional vacuum filters. Other important benefits are:

- Rotabelts can discharge cakes as thin as  $\frac{1}{8}$  in.

- High vacuum levels minimize cake moisture and, in some cases, double filtration rates.

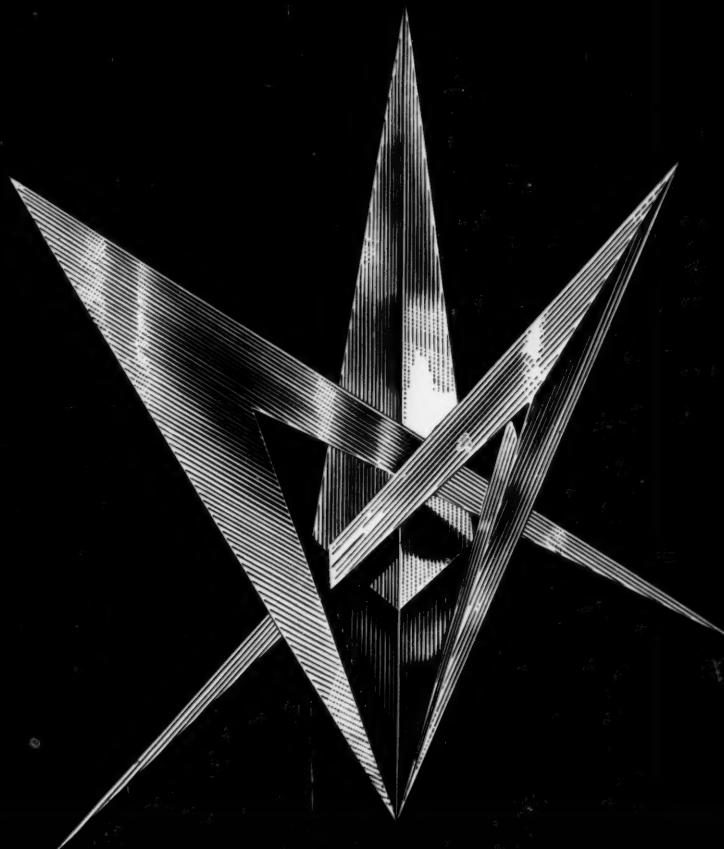
- Filtrate blowback is impossible.

- Filtrate clarities equal or better those from conventional drum filters.

- Discharge blades do not abrade media.

- Downtime for media change is a matter of a few minutes.

► **Wire Mesh First, Now Cloth**—Rotabelt filters cannot be called a brand new development. To date, 18 Rotabelts have gone into operation, the first two units having been installed in the autumn of 1955



# QUALITY IN STAINLESS STEEL

Quality in stainless steel starts in the melt shop, where Industry Standards are met — or missed.

1 out of every 7 tons of stainless used in the last 15 years came from the melt shop of J&L's Stainless and Strip Division. To achieve that remarkable record as a supplier of semi-finished products, J&L set up its own standards and specifications — far more exact, more precise, *more rigid* than those in general use. Today J&L leads the industry in melting practice standards — the point where quality starts.

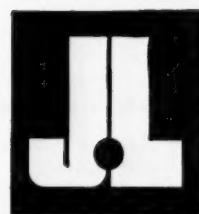
Chances are 1 out of 7 you have already enjoyed J&L quality in stainless, without knowing its melt shop origin. Now you can eliminate chance! Newly installed cold rolling and finishing equipment in operation at Louisville, Ohio, makes J&L the most modern *integrated* source for *finished mill products* — stainless sheet, strip, bar and wire. All of traditional J&L stainless quality.

On your next stainless steel order specify "J&L Consistent Quality." Don't pay for less.

*Plants and Service Centers:*

Los Angeles • Kenilworth (N. J.) • Youngstown • Louisville (Ohio) • Indianapolis • Detroit

"FLIGHT OF PROGRESS"  
a stainless steel sculpture by Robert Edward Hamilton



**STAINLESS**  
SHEET • STRIP • BAR • WIRE

**Jones & Laughlin Steel Corporation • STAINLESS and STRIP DIVISION • Box 4606, Detroit 34**

at Fond du Lac, Wis., in the city sewage treatment plant. In addition, Eimco has sold six more units, which are expected to start up within the next year. All of these filters use stainless steel woven-wire media; however, the company has recently announced the availability of cloth-media Rotabelts.

Primarily, the machines have made their biggest hit in sewage treatment applications (19 out of 24 units). But this trend may be changing. According to Eimco's Rotabelt development engineer, Conrad Cornell, "We feel that the time is just about ripe for cracking into a much wider marketplace than sewage. I think you can expect to begin seeing Rotabelts taking over filtration jobs in various chemical plants."

Thus far, Ford Motor at Indianapolis has an 8-ft.-dia. by 6-ft.-face unit for the filtration of industrial wastes and pickle liquors. A. E. Staley at Decatur, Ill., uses two 10 x 10-ft. units on gluten and fine fibers. And American Box Board at Filer City, Mich., has a machine for clarification of black liquor streams from pulp and paper operations.

Moreover, Eimco claims that tests run by a trailer-mounted pilot Rotabelt at various plants around the country indicate that the unit offers "considerable economic advantages" for many operations. Materials tested included barium sulfide solutions, leached lithium ores, pectin, beer slurry and cane sugar.

**Sizes and Cost** — Rotabelts come in sizes ranging from 18-in. dia. by 12-in. face to 11½ ft. x 16 ft. Initial costs run up to 20% more than conventional drum filters; the larger units are more comparably priced.—Eimco Corp., Salt Lake City, Utah. 100A

### Packaging Material

Made of laminated paper and plastic.

St. Regis Paper Co. and Monsanto Chemical Co. have just announced formation of Fome-Cor Corp., which will manufac-

ture a new plastic-paper "sandwich" material.

This material, known as Fome-Cor, retains high compression strength under severe moisture conditions. In addition, it exhibits good insulation and cushioning properties, and is light in weight. A wide variety of uses as a container construction material is one of Fome-Cor's expected applications.—Monsanto Plastic Div., Springfield, Mass. 102A



### Vertical Motors

Climatized units for process applications.

Vertical hollow-shaft motors in ratings of 1 to 30 hp. are available for indoor and unprotected outdoor service on shallow or deep-well turbine pumps. Motor design offers greater compactness for space savings and handling ease, and incorporates recent advances in insulating materials.

Using a wrench as the only tool, in-the-field assembly or removal of coupling and thrust bearing takes only 5 min. An oil-metering system, sealed bearing chambers and Alnico drain plug protect bearings.

Optional equipment includes non-reverse ratchets, bearing and winding thermoguards, space heaters and snow covers.—The Louis Allis Co., Milwaukee, Wis. 102B



### TV Mount

Makes continuous area surveillance possible.

A new heavy-duty television camera mount broadens the area that can be continuously monitored by a single closed-circuit TV system. The mount circles from side to side and tilts up and down, panning the camera over an adjustable sector. Built-in speed controls enable variation of the scanning cycle over a wide range.

Control panels up to 3,000 ft. away from the camera provide complete command over the scanning action. Horizontal scanning speed is variable from 0 to 12 deg./sec.; tilting speed adjusts from 0 to 4 deg./sec.—Kin Tel Div., Cohu Electronics, San Diego, Calif. 102C

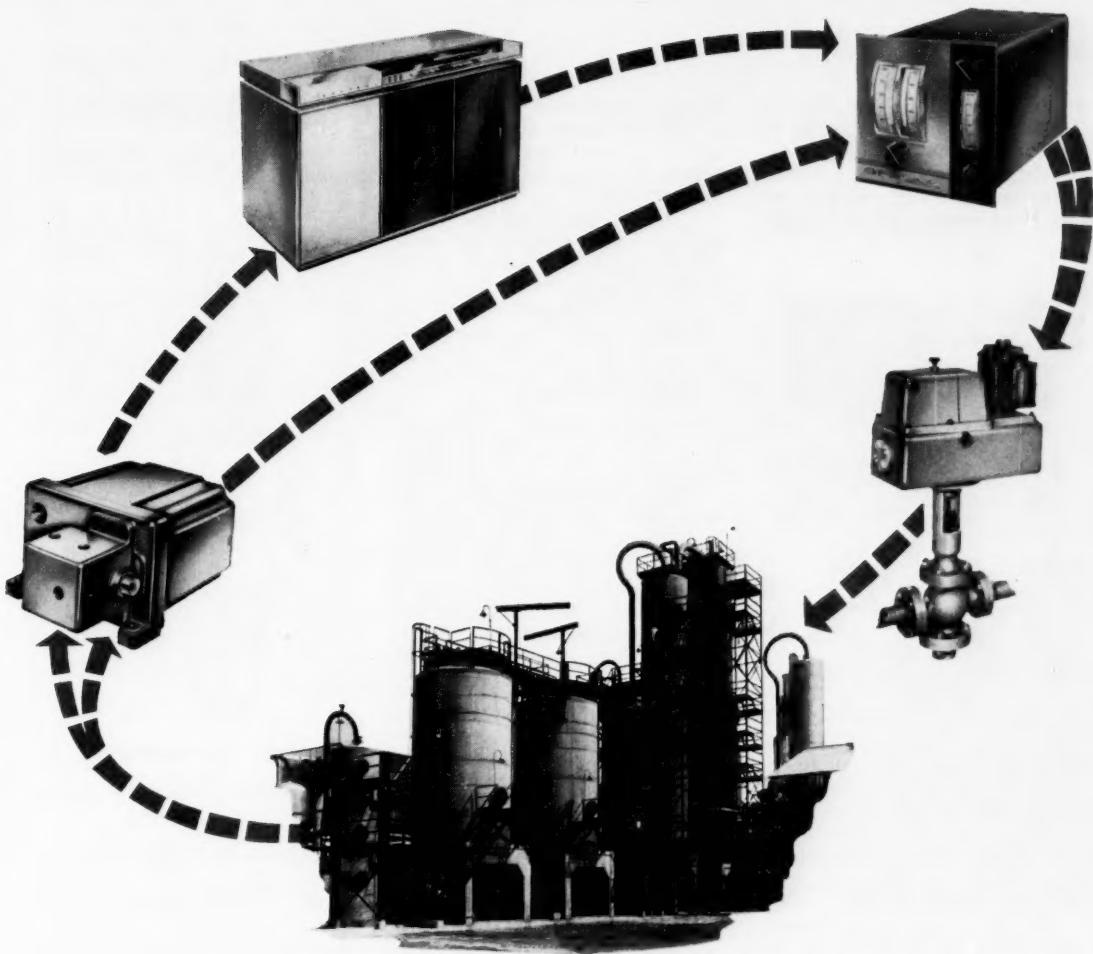
### Flame Detector

Universal device detects ultraviolet rays.

Minneapolis-Honeywell has introduced what it describes as a universal detection device for use with all types of industrial burners. Heart of the system is a recently developed ultraviolet-sensitive tube.

An amplifier circuit adds up impulses of electrical energy generated by the tube as it counts the ultraviolet rays present in all flames. Since the tube responds only to ultraviolet light, the device is unaffected by hot refractories, incandescent light, hot metal or any flickering radiation in the visible or infrared regions.

Ambient temperature rating



## GPE Controls can close the loop in computerized process control

You can realize the benefits of modern computerized process control—today—because GPE Controls, Inc. can supply closed-loop system components manufactured by its own divisions and designed to operate together.

- **Transmitters for process variables, and controllers—made to operate with computers**
- **The Libratrol-500 digital computer . . . with built-in analog-to-digital input and digital-to-analog output**

- **Link expandable special-purpose data-processing systems**

- **Electro-hydraulic valve actuators from 200 to 200,000 lbs. thrust**

These performance-matched components, coupled with a quarter-century of experience in industrial automatic controls, assure optimum performance whether you need a closed-loop system or an expandable data-processing system.

**GPE**  
Controls

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GENERAL  
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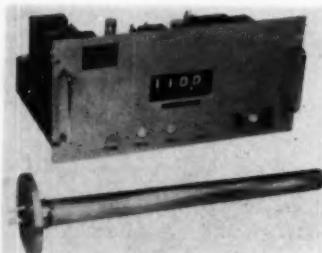
*Write for information on this unique GPE Controls service*

**GPE Controls, Inc.** (formerly Askania Regulator Company)  
240 East Ontario Street • Chicago 11, Illinois

A Subsidiary of GENERAL PRECISION EQUIPMENT CORPORATION

## EQUIPMENT DEVELOPMENTS . . .

of the system is 50-135 F., but it can sight temperatures up to 2,200 F. without back light effect. List price is \$120.—**Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.** 102D



### Liquid Level Gage

Electronic device has no moving parts.

Accuracies as high as 1/10 in. over a 10-ft. height are claimed by the manufacturer for the new Model 0358-1 liquid level gage. The new instrument employs a capacitance circuit that requires no moving parts in the liquid being measured. Model 0358-1 is also applicable to measurement of height of some types of granular solids.

System design makes it possible to monitor a number of vessels for total volume and weight in all tanks, as well as that of each tank. Readout is available from either dial, counter or strip-chart recorder.—**Magnetic Instruments Co., Inc., Thornwood, N. Y.** 104A

104A

### Electron-Beam Welding

Moves step closer to commercial application.

Electron-beam welding machines for commercial applications will soon be available from Stauffer-Temescal Corp. At present, the company is using a prototype machine to demonstrate completed-weld properties, and to show off special attributes of the welding process itself.

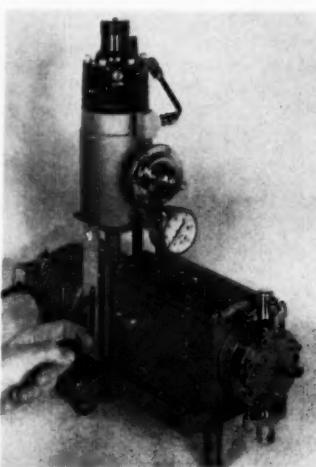
All electron-beam welding is performed under extremely low vacuum (about 0.1 micron) in a special chamber. In operation, the welder focuses a stream of

filament-generated electrons to a working area about 1 mm. square. Power can be readily regulated from zero to maximum.

Chief advantage of the process over arc welding is that close control of power level produces an exact welding zone without hot spots. Another claimed benefit is that the distance between work and cathode is less critical than that for arc welding—thus, the new system excels in making good welds on difficult configurations.

Electron-beam machines are expected to find initial use for producing dense welds for reactive, high-melting metals such as molybdenum, columbium, tantalum and beryllium.—**Sauffer-Temescal Corp., Richmond, Calif.** 104B

104B



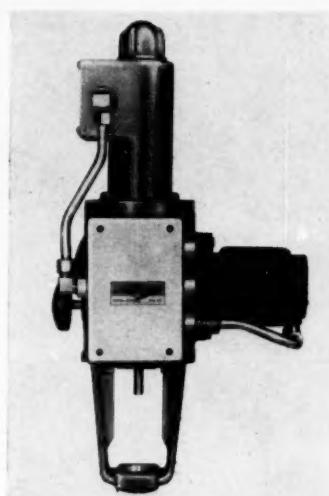
### Metering Pump

Automatic unit controlled by air pressure.

A new explosion-proof pump known as the Auto-Pneumatic Micro-flo Pulsafeeder provides an automatic means of metering chemicals without using constant-level controls, head tanks or measuring tanks. Auto-Pneumatic's output from 0-100% is controlled by air pressure variation from instruments with a range of 3-15 psig.

In operation, an integrally mounted air cylinder utilizes the instrument signals to change position of the pump's

stroke-adjusting mechanism. A built-in positioner assures immediate response.—**Lapp Insulator Co., Le Roy, N. Y.** 104C

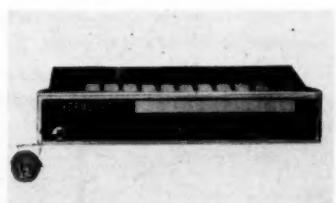


### Electric Actuator

Affords precise proportional positioning.

According to the manufacturer, the new, all-electric Model D-62XW actuator provides economical automatic positioning for throttling control of valves, dampers, louvers and speed changers. It will also enable remote pushbutton control, with optional position indication.

Model D-62XW comes in a variety of travels ranging from  $\frac{1}{4}$  to 4 in., and with a maximum thrust of 700 lb. Stroking speeds are 8.5 in./min. at 100 lb. load to 2.5 in./min. at 700 lb. load.—**Conoflow Corp., Philadelphia, Pa.** 104D



### This Is a Batcher

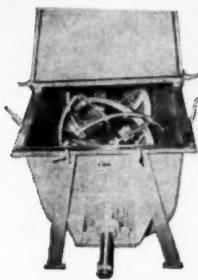
For its vital role in new batching system, see p. 110

**NEW...**

**STRONG-SCOTT  
INDUSTRIAL  
RIBBON  
BLENDER**



Rounded tub ends prevent material hang-up, neoprene cover-seals provide dust-tight fitting.



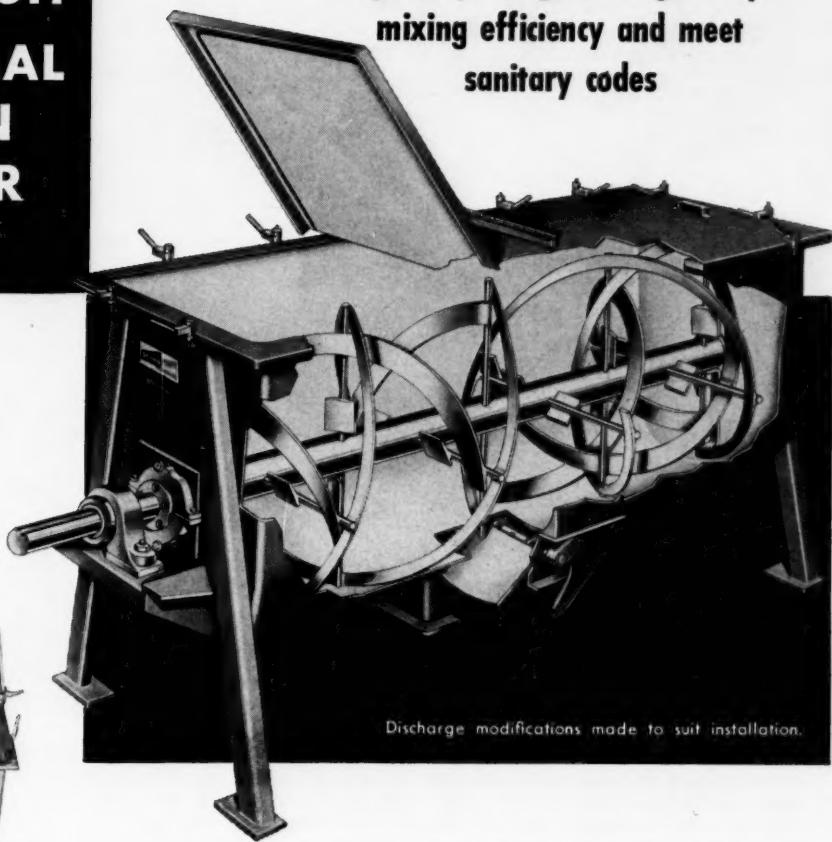
• Swing or slide-type discharge gate, curved to eliminate dead pocket.

• Unique coupling permits vertical removal of agitator assembly without disturbing shaft ends and bearings.

• Heavy-duty, outboard anti-friction bearings.

• Air-purge, lip seal or stuffing box seals readily removed for quick cleaning.

• Dust-tight covers, with quick-action clamps.



**Specially designed to give top mixing efficiency and meet sanitary codes**

Top mixing efficiency with the new Strong-Scott Ribbon Blender mixer on dry or semi-dry materials, has been proven through continuous testing. The Ribbon Blender also meets requirements of health codes where necessary.

The ability to thoroughly and quickly mix is provided by a unique "ribbon assembly." The smallest amount of additives are thoroughly mixed in a matter of minutes. Special smooth-surface, cornerless welding and rounded corners throughout, leave no place for material to gather. The cover is seal-tight for maximum cleanliness and dust control.

Nine different size units ranging from 16 to 300 cubic feet working capacity are available in stainless steel or carbon steel. Jackets for heat transfer mediums also available.

**PLAN 59** Modernize now for growth and profits

The **Strong Scott** Mfg. Co.

451 Taft Street N. E., Minneapolis 13, Minnesota

## How Blaw-Knox cuts your power piping costs



**121,000 square feet of space at your service.** Power piping facilities at Pittsburgh include 56,000 square feet of plant area and an additional 65,000 square feet for exterior storage. An additional new plant is located on a 15-acre site in Jackson, Mississippi.

Your job is under the personal supervision of an experienced engineer, who follows your project from beginning to end. Your piping is handled with the most modern equipment for welding, heat treating, and bending. Fabricating techniques, proven by rigid testing, are used.



**New product development.** Blaw-Knox developed an enclosed type of functional spring hanger as part of their complete line of hangers for supporting any piping system. Here a group of hangers individually designed for a project is factory checked to assure fast field erection.



**Stress calculation cut from months to a day . . .** with pace-setting engineering. An exclusive Blaw-Knox method uses an electronic computer for automatic computation with no limitation on the complexity of system. Full accuracy, with tremendous savings in time and cost. Write for details.



**BLAW-KNOX COMPANY**  
Power Piping Division  
829 Beaver Avenue, Pittsburgh 33, Pennsylvania

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## Is there anything Wyandotte technical service can't do for you?

Of course there is!

For instance . . .

We could *not* do your research for you even if you wanted us to; for your own scientists know far more about *their* business and your products than we do.

But we *can* give you the kind of helpful technical assistance your scientists need and want. We can supply background information on the applications of our products to yours. We can tell you the chemical and physical properties of our products, as well as other pertinent characteristics. We can give you their specifications and limitations—give you valuable tips on proper handling, storage, etc. And all of this *can* make your

research easier and save you valuable time.

And we *can* arrange consultations with our science-specialists\* on any product or processing problems that indicate a possible use of one or more of our products, or may suggest the development of a new product *by us*.

We think this is an honest description of Wyandotte technical service—not only a department, but a deep-rooted and sincere philosophy of doing business. If you would like to take advantage of it, just send us full information.

For a pictorial presentation of Wyandotte technical service at work, please turn page.

\*Chemists, Chemical Engineers, Physicists, etc., whose industrial or research experience qualifies them as specialists in their particular field.

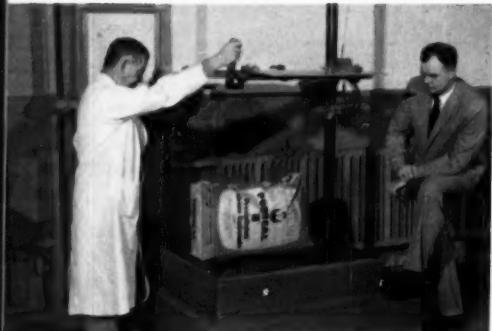


SODA ASH • CAUSTIC SODA • BICARBONATE OF SODA • CALCIUM CARBONATE • CALCIUM CHLORIDE • CHLORINE • MURIATIC ACID • HYDROGEN • DRY ICE • GLYCOLS  
SYNTHETIC DETERGENTS (anionic and nonionic) • SODIUM CMC • ETHYLENE OXIDE • ETHYLENE DICHLORIDE • POLYETHYLENE GLYCOL • PROPYLENE OXIDE  
PROPYLENE DICHLORIDE • POLYPROPYLENE GLYCOL • DICHLORODIMETHYLDANTOIN • CHLORINATED SOLVENTS • OTHER ORGANIC AND INORGANIC CHEMICALS

# BETTER PACKAGING



*... an example of Wyandotte technical service at work*



1 Before selecting a package—this bag, for example—we subject it to exhaustive tests for strength, design, construction, and appearance. Proper packaging helps customers use the product more efficiently, protect its inherent quality . . . a prime function of Wyandotte technical service.



2 Palletizing poses several problems: type of pallet, arrangement of bags, design of bag, type of glue, and others. All of these problems are the subject of continuing research at Wyandotte . . . extending from our plants to customers' railroad sidings.

3 Technical service also looks into our customers' tank-car needs. Different products require different types of lining. Insulation and heating elements must be carefully selected. Valves and outlets must be checked, safety precautions followed.



4 Large users located near waterways can save thousands of dollars annually with barge shipments. Wyandotte technical service offers extensive experience with barges, plus help in the design and construction of unloading and storage facilities.

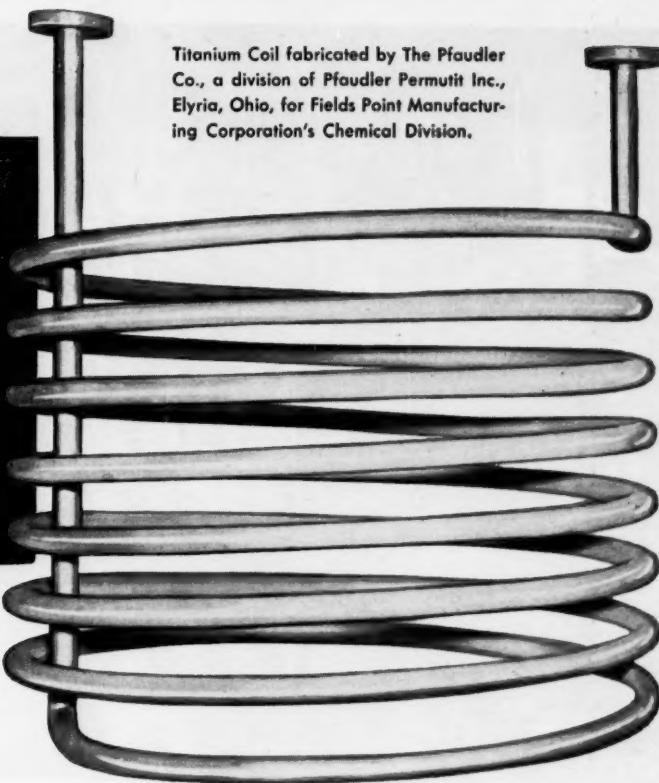


From bags to barges, Wyandotte technical service is at work helping our customers—not only with packaging, but with research and application assistance to make sure they get the most from the products they buy. Isn't this the kind of help you're looking for?

If you have a problem that falls within our technological or manufacturing background, check with us . . . our approach is designed to provide answers. *Wyandotte Chemicals Corporation, Michigan Alkali Division, Wyandotte, Michigan. Offices in principal cities.*

**TITANIUM COIL**  
**proves durable**  
**in sodium**  
**hypochlorite**

Titanium Coil fabricated by The Pfaudler Co., a division of Pfaudler Permutit Inc., Elyria, Ohio, for Fields Point Manufacturing Corporation's Chemical Division.



**expected to outlast silver...initial cost is less**

The corrosive action of chlorine gas bubbling through a sodium hypochlorite solution meant replacement of cooling coils regularly. Even silver pipe lasted only about 2,500 batches.

Experiments with titanium were encouraging and after 6 months' exposure under operating conditions there was no detectable deterioration.

The first coil fabricated from Damascus titanium 2" O.D. x 16 ga. tubing was installed and is now in service. Fields Point Manufacturing Company anticipates a service life of at least 5,000 to 10,000

batches. And the purchase of additional titanium coils is being considered.

Titanium being stronger than silver, a lighter gauge tube could be employed. Since fewer pounds of material were required, this meant the initial cost of the titanium coil was less than one made from silver.

For general corrosive service, Damascus offers stainless steel pipe and tubing in a full range of A.I.S.I. standard analyses but, where unusual corrosive service is encountered, can furnish exotic metals and special alloy grades.

**COMPLETE INFORMATION ON RARE AND REACTIVE METALS PIPE AND TUBING**

New 44-page handbook contains data on applications, heat treatment, corrosion resistance, chemical and physical analysis, mechanical properties of Zirconium, Zircaloy 2, Zircaloy 3; Titanium, grades 40, 55, and 70; Precipitation Hardening Steels, A-286, 17-7-PH, 15-7-MO; HASTELLOY ALLOYS, A, B, C, F, and X.



**DAMASCUS TUBE COMPANY**

Greenville, Pa.

Gentlemen: Please send me your new 44-page handbook.

NAME \_\_\_\_\_

COMPANY \_\_\_\_\_

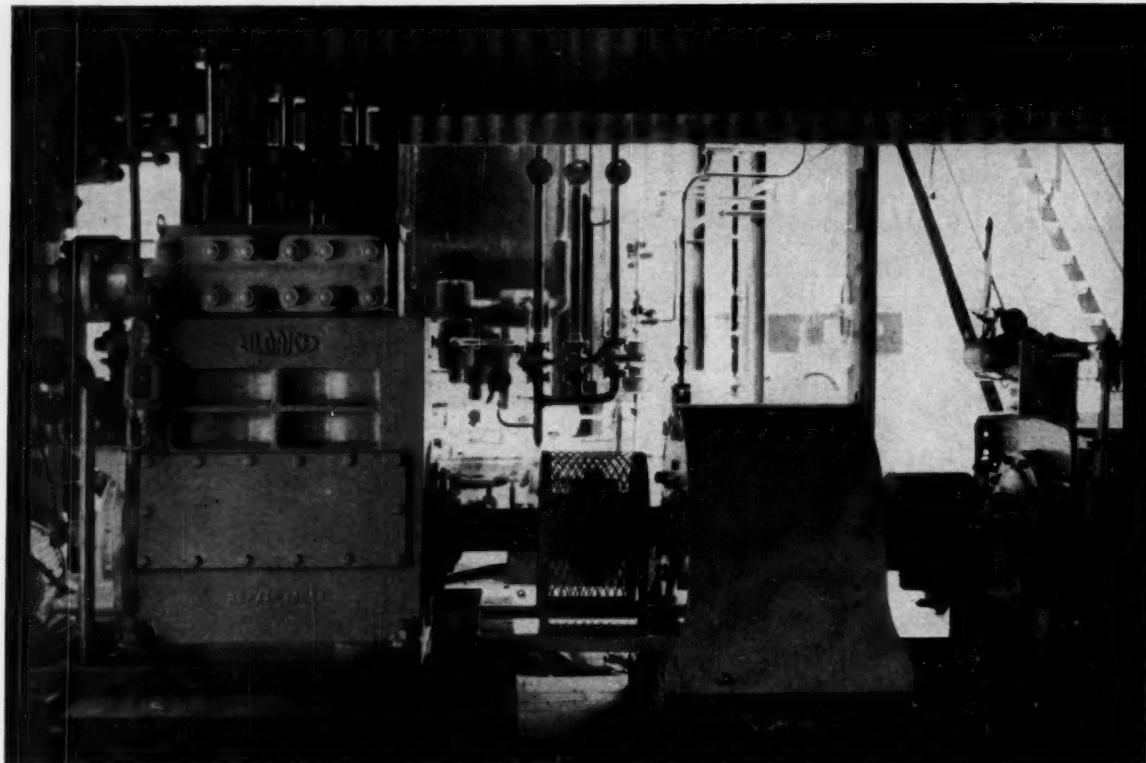
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CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_



**AMASCUS TUBE COMPANY**

STAINLESS STEEL TUBING AND PIPE  
 GREENVILLE, PENNSYLVANIA



## THE PRESSURES ARE HIGH...THE LIQUIDS CORROSIVE...THE PUMPS ARE ALDRICH...

At the Houston plant of Rohm & Haas Co., this Aldrich pump alternately introduces caustic and brine into one phase of the acrylate process for producing acrylic monomers.

**The problem:** Handle highly corrosive liquids at 3000 psi in a continuous process and *not* have severe maintenance problems.

**What Rohm & Haas did about it.** Company engineers specified Aldrich 1 $\frac{5}{8}$ " x 5" stroke Triplex Pumps for three reasons.

1. Compact, heavy-duty construction makes Aldrich pumps ideal for high pressure service.
2. Aldrich pumps are designed for easy maintenance. Fluid-end sectionalization permits quick removal of valves for inspection or replacement. No special tools are required.
3. Aldrich engineers can draw upon a vast store of experience when it comes to selecting the right materials for any pumping job. In this case, the entire fluid end . . . working barrel, suction and discharge manifolds . . . are forged Monel. Valve seats are Haynes

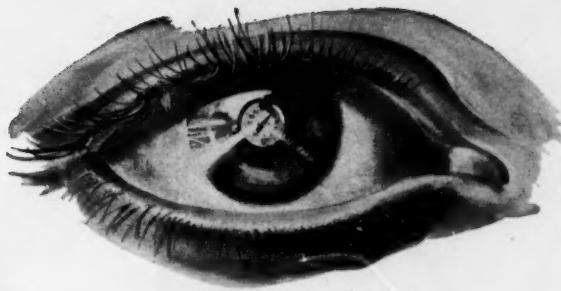
Stellite. Valves and plungers are K Monel.

**Results:** According to the Plant Manager of the Houston plant, "maintenance requirements have decreased and pumping production improved. These Aldrich pumps lend themselves to easy maintenance."

**How Aldrich can help you.** Solving pumping problems like this requires specialized engineering skills and experience. We have those skills, and our experience comes from years of working with the chemical industry. We welcome the opportunity to discuss your specific problems . . . no matter what the liquid or how high the pressures. Aldrich Pump Company, 3 Gordon Street, Allentown, Pa.

**the toughest pumping problems go to**





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you read  
is right**

The new, patented Maxivision dial on American Bi-Metal Thermometers eliminates the perspective effect of usual pointer-above-dial construction. No parallax! Readings are sure, sharp and accurate — exact working temperatures are always right before your eyes. It is a two-level dial. A raised outer ring, set close to the cover glass, carries the graduations. The index type pointer is on the same plane as the outer ring, with the numerals on a lower level.

What you read is right when American Bi-Metal Thermometers with anti-parallax Maxivision dial are installed at important check points on your processing facilities. Mounting styles, dial sizes, temperature ranges and stem lengths are available to meet the most exacting requirements. Let your nearby industrial distributor help you select the best combination for each location.

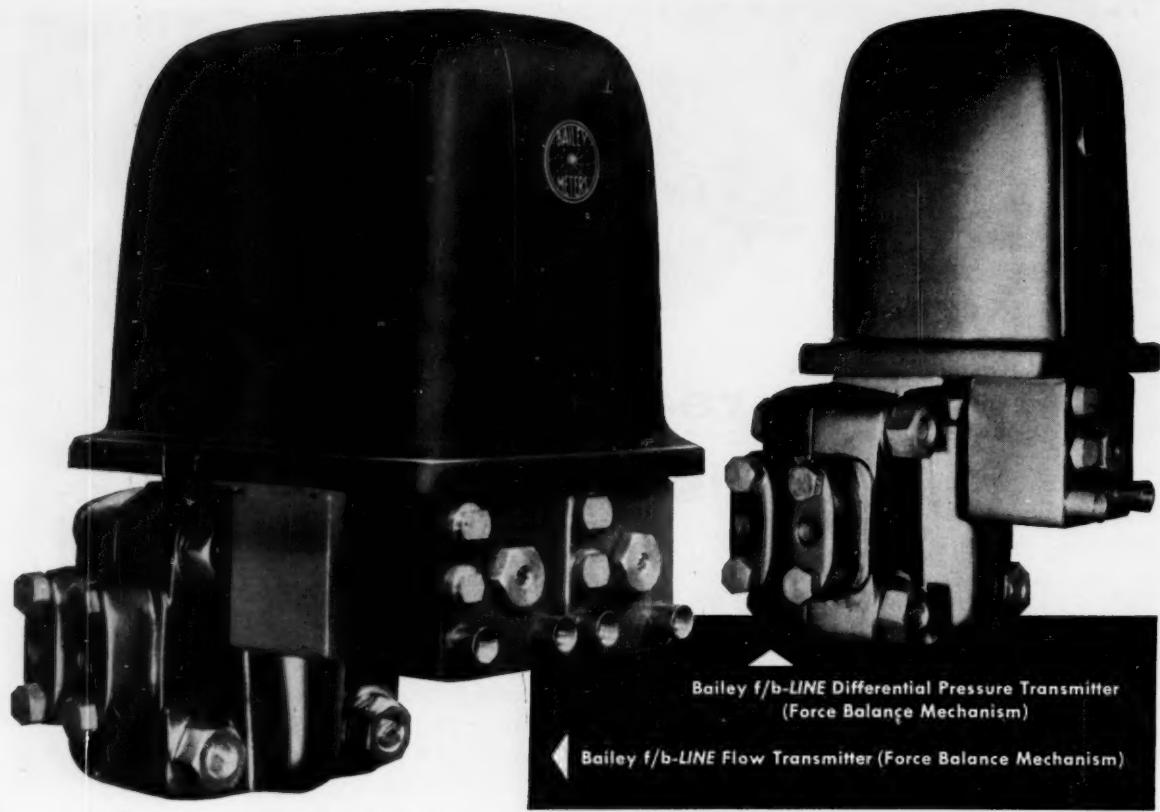
American Bi-Metal Thermometer  
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Pneumatically transmits rate of flow—or differential pressure—measurements to indicating, recording, and/or controlling equipment at remote stations. Transmitters consist of a diaphragm measuring mechanism and a force balance pneumatic transmitting unit.

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For steam, water, air, gases and other fluids producing differentials across primary elements from 0-2 in. H<sub>2</sub>O to 0-2000 in. H<sub>2</sub>O at maximum service pressure of 50, 1500, and 5000 psig.

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**Transmits a Signal Directly Proportional to Rate of Flow.** Uses receiver with uniformly-graduated chart or scale. Eliminates need for external square-root extractors or characterizers.

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**Screwdriver Adjustments.** Range and zero adjustments readily accessible. Range may be changed with screwdriver adjustment.

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**Corrosion Resistant.** For maximum differentials between 20 and 2000" H<sub>2</sub>O, all parts in contact with process fluid may be stainless steel. No sealing fluids or sealing diaphragm required.

**Good Stability.** Reset type boosters give good stability with high gain.

**Versatile Mounting.** May be mounted on process piping, wall, or separate mounting pipe using same bracket.

For additional information, call your local Bailey District Office, or write direct.

CP3-1

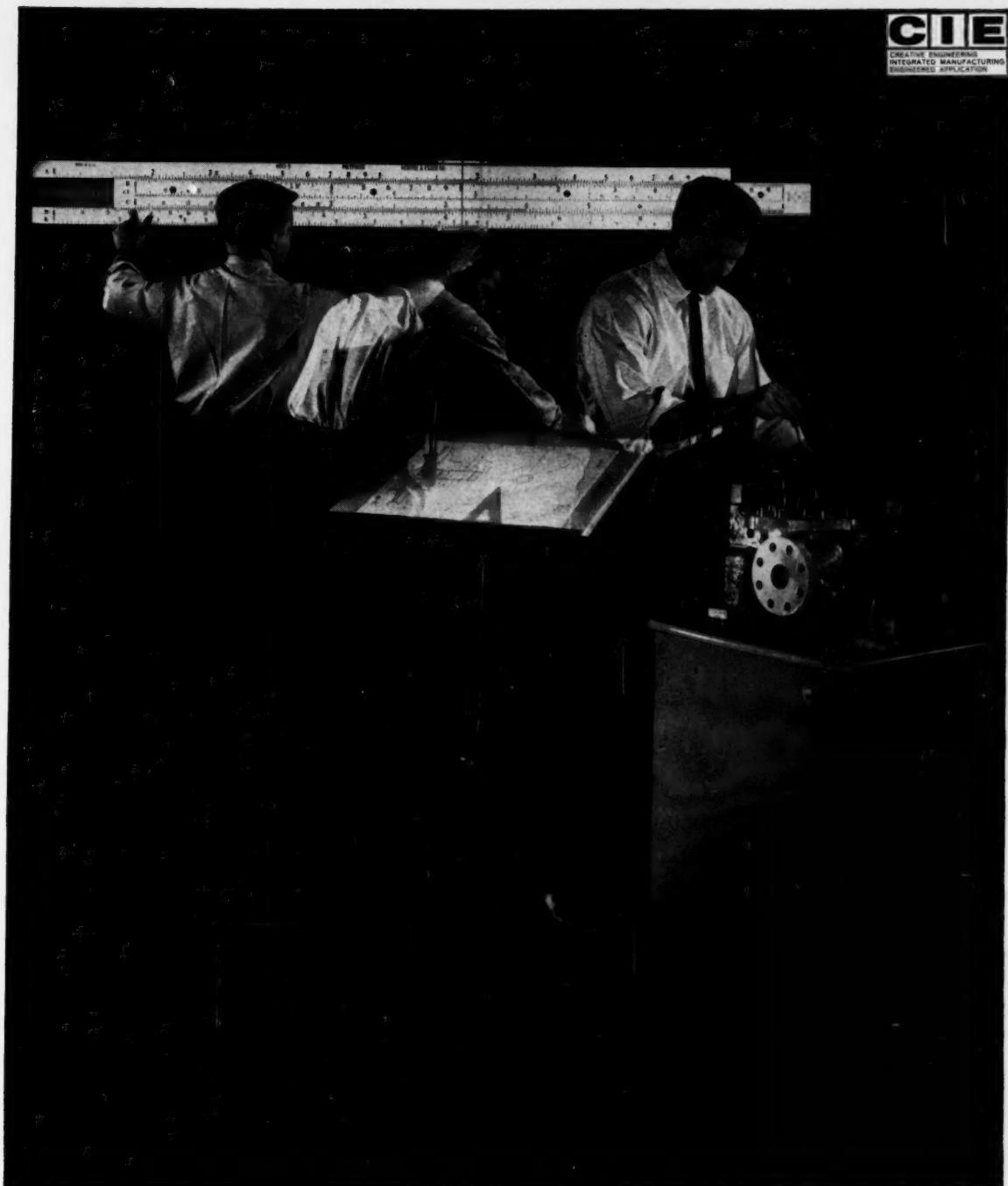
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and vapors. Such achievements point out that every Goulds pump is built to lick a problem—perhaps *your* problem!

To find out what's available to solve your pumping problems, write to: Goulds Pumps, Inc., Dept. CE-49, Seneca Falls, New York.

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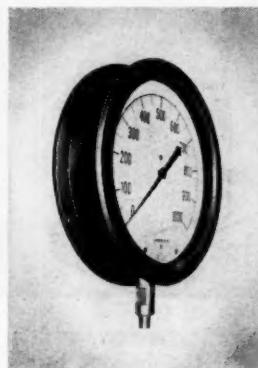
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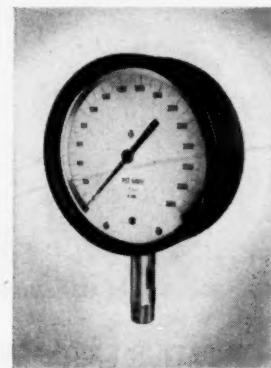
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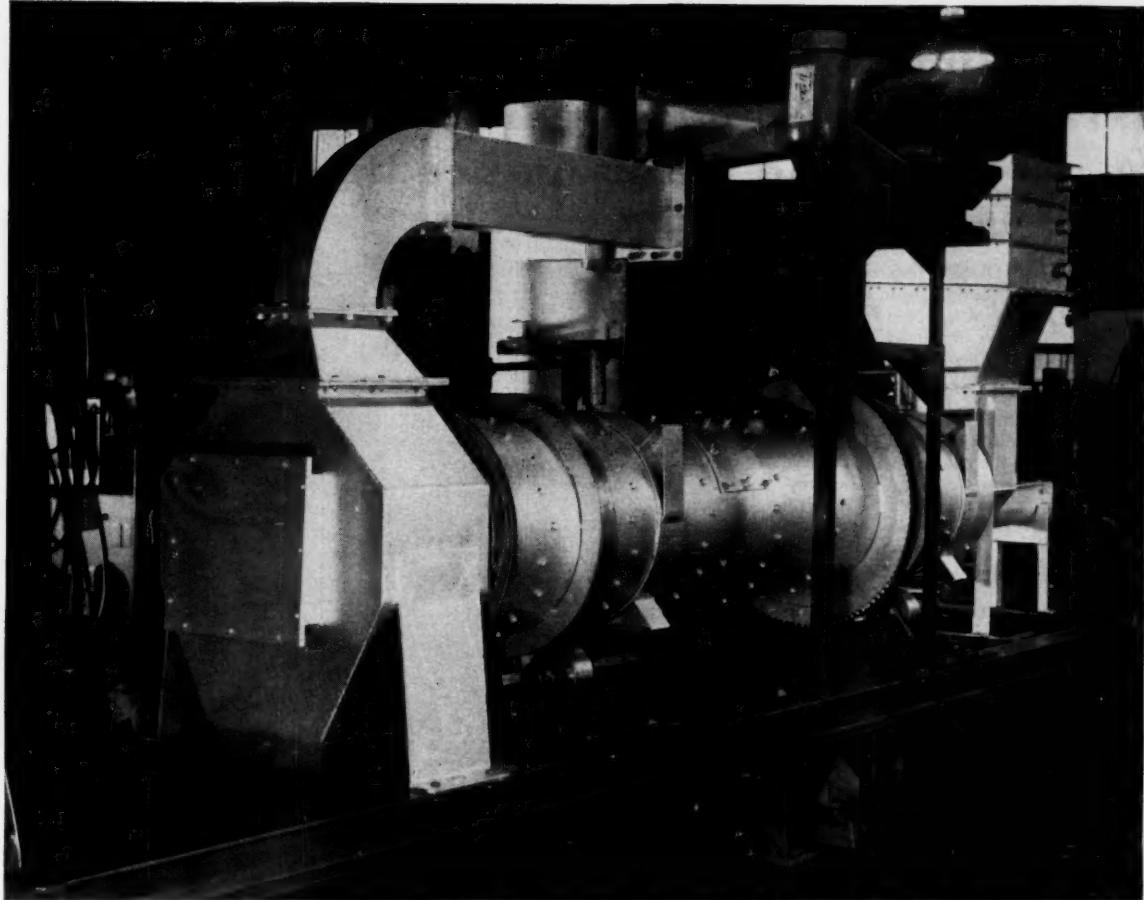
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# Simplicity in steam traps can effect big savings in parts inventory and maintenance time

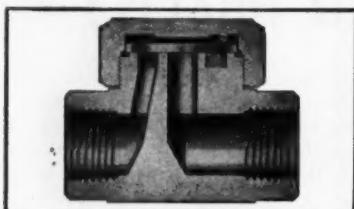
by John W. Ritter, Test Engineer  
SARCO Company, Inc.

The function of all steam traps is to release condensate and prevent steam loss. However, the method of trapping can make a great difference in cost and effectiveness.

In the Sarco Thermo-Dynamic Steam Trap, the method is fundamental. Air or condensate entering the trap must flow from the inlet tube, radially across the underside of the disc valve, to the outlet. The space between the inlet tube and the disc forms a nozzle in which the static pressure of the incoming fluid is partly changed to velocity across the underside of the disc, with a resultant *decrease* in pressure. (This will be recognized, of course, as the Bernoulli Principle.) Use of this fundamental method means reliability in operation.

As the high velocity fluid jet strikes the side of the upper chamber, some recompression takes place, so that the pressure above the disc becomes greater than the pressure below it. The pressure reduction under the disc and the pressure recovery above it depend on the internal energy of the fluid. As the condensate above nearly approaches steam temperature, its internal energy is enough to overcome the upward force at the inlet tube and the disc snaps down in the inlet tube, which is the inlet valve seat.

Simultaneously, the disc also seals the outer ring, which isolates the space above the disc from the outlet. The disc valve is therefore held firmly against the inlet valve seat until the pressure in the control chamber is reduced by condensation. The upward force then exceeds the downward force and the disc valve opens.



This 3-part Sarco TD Steam Trap has only one moving part—the hardened, polished stainless steel disc.

No other trap uses the velocity of the fluid to operate the valve or uses the recompression of the flowing fluid to trap the valve closed and to hold it closed. When it closes, it closes tightly—no "operating steam" leaks out.



## 40 seconds inspection time— that's all it takes for a SARCO TD Steam Trap

Just back off the cap of a Sarco TD. Lift out its single moving part, the stainless steel disc. Wipe it off, and drop it back. No adjustment is ever required, at any load or any pressure in its range—from 10 through 600 psi.

The TD operates in any position, won't blow steam at any load. Small as a tee fitting, it can be installed in tight places. Its versatility and reliability cut cost of big replacement inventory.

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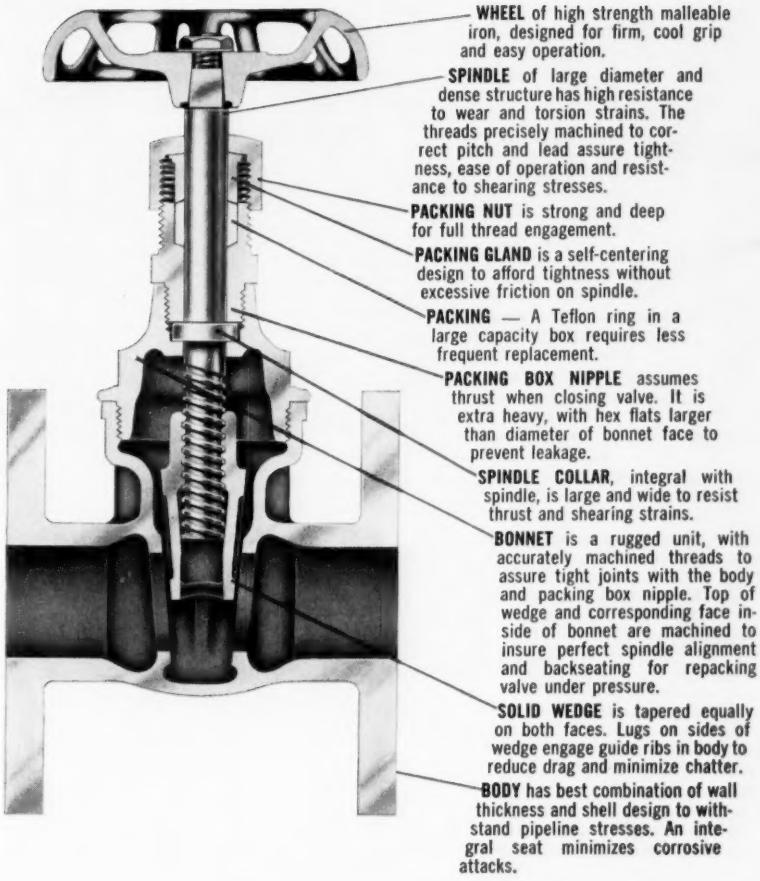
This dollar-saving Solid Wedge Gate  
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BECAUSE Jenkins puts an extra-measure of quality in this Fig. 1300 Solid Wedge, Inside Screw Gate Valve you will find it satisfies the needs of many services for which a more costly type often would be used. Look at the many superiorities in design and construction shown here. You'll conclude that it's hard to beat Jenkins at making valves, no matter what the material.

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## PROCESS FLOWSHEET C. S. CRONAN

# The Chemical Route to... Peroxide

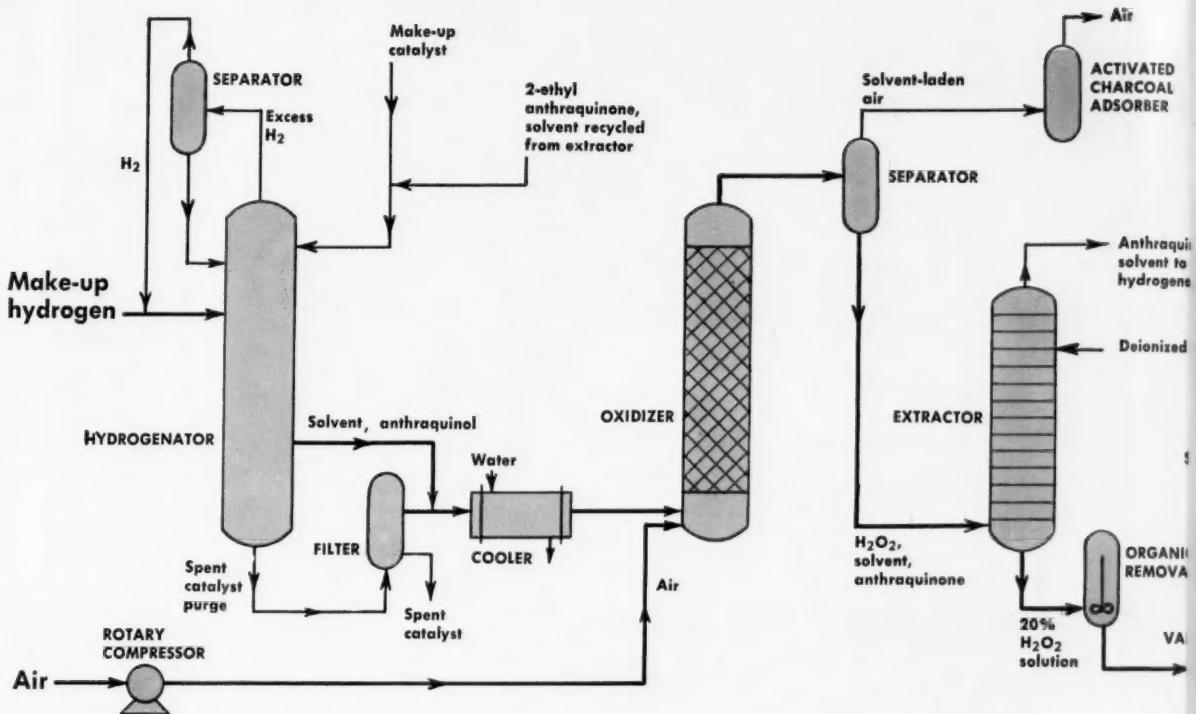
Latest convert to the autoxidation process for hydrogen peroxide is Britain's Laporte Chemicals.

**H**YDROGEN peroxide producers have been debating among themselves for the past decade on the relative merits of the electrochemical vs. "chemical" autoxidation processes for making  $H_2O_2$ . Latest producer to switch over to the autoxidation process is England's Laporte Chemicals, Ltd., which brought a \$7-million plant on stream at Warrington last October. Capacity of the new unit is not revealed, but it is billed as "world's largest."

In this country, at least five producers already employ the chemical route to  $H_2O_2$ : Du Pont, Columbia-Southern, Allied Chemical, Shell Chemical and Becco Chemical. Very few details have been published about the engineering of U.S. autoxidation plants, but observers believe they are similar to the new Laporte unit.

Main lure of the autoxidation process stems from low utility requirements: about 1.4 kw./lb. of  $H_2O_2$  compared with 6.4 kw./

Unfold Flowsheet 



lb. for the electrochemical route. Too, steam requirements are lower in the autoxidation process because there is no hydrolysis of persulfate compounds. And in the electrochemical process, size of the cell is the limiting design factor; a plant can only be scaled up by adding more small units.

► **Missiles and Bleached Blondes**—Production capacity for  $H_2O_2$  in the U.S. has grown nearly 250% in the last decade.

Most glamorous outlet for peroxide is in energy sources for rockets and missiles. It can be used as an oxidizer in liquid bipropellant systems or as a monopropellant through controlled catalytic decomposition. Much of the output of the new Laporte plant is slated for fuel applications.

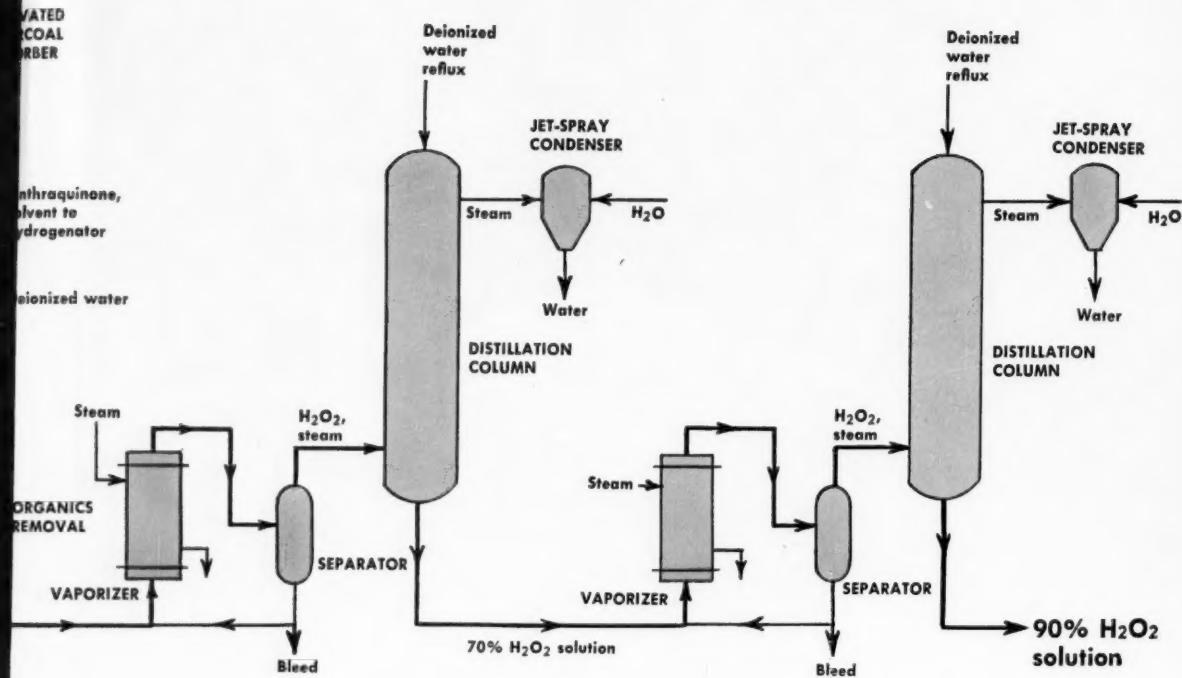
Most  $H_2O_2$  production goes into bleaches for cotton, wool, groundwood pulp—and for making the hair color that gentlemen are said to prefer. Chemical manufacturing also consumes large amounts of peroxide where the highly reactive  $H_2O_2$  molecule is ideal for oxidation, epoxidation and hydroxylation reactions. And an important growth area is in the use of  $H_2O_2$  as a gas source in foaming rubber and plastics.

► **Search for Solvents**—Basis for the autoxidation process is the hydrogenation of an organic molecule (e.g., anthraquinone) in solution to form an OH group which is then oxidized to form  $H_2O_2$ , regenerating the original organic molecule which is recycled. Theoretically, only hydrogen, atmospheric oxygen and water are consumed in the process.

Main process difficulty is finding a solvent that will minimize side reactions during hydrogenation while at the same time dissolving both the hydrogenated and oxidized forms of the organic compound. Among solvents mentioned in the literature are benzene-methyl-cyclohexanol mixtures and primary and secondary nonyl alcohols. The German firm Degussa recently obtained a preliminary patent on its autoxidation system which employs a methyl ketone solvent of the type  $CH_3-CO-R$ , where R is a substituted aromatic group. Laporte's solvent is described only as a mixture of an aromatic and a cyclohexyl ester.

Hydrogenation catalyst is identified by Laporte only as a palladium catalyst supported on an inert carrier.

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► **Aluminum Wins Out**—Because impurities in  $\text{H}_2\text{O}_2$  cause spontaneous catalytic decomposition, strictest purity precautions are taken in every step of the process. These precautions make  $\text{H}_2\text{O}_2$  one of the purest chemicals in commercial production.

In the new Laporte plant, aluminum was used extensively because its surface is passive enough to prevent peroxide decomposition in the vessels during processing. Even pressure vessels with walls up to 1.5 in. thick were made from aluminum through special stepped construction techniques and argon-arc welding. Much of the aluminum equipment and piping was pickled after fabrication to insure chemical inactivity.

Older German plants use enameled steel vessels to achieve chemical inactivity, but these vessels are more expensive and limited in size.

► **Start With Hydrogen** — Hydrogenation-oxidation cycle takes place in two identical units operating in parallel up to the extraction stage—where the two streams mix.

To start off, excess hydrogen from the butane cracking plant mixes in a vertical aluminum vessel, 40 ft. high and 10.5 ft. dia., with the palladium

catalyst and 2-ethyl anthraquinone dissolved in the solvent. Reaction product is 2-ethyl anthraquinol (substitution of two OH groups on the anthraquinone molecule).

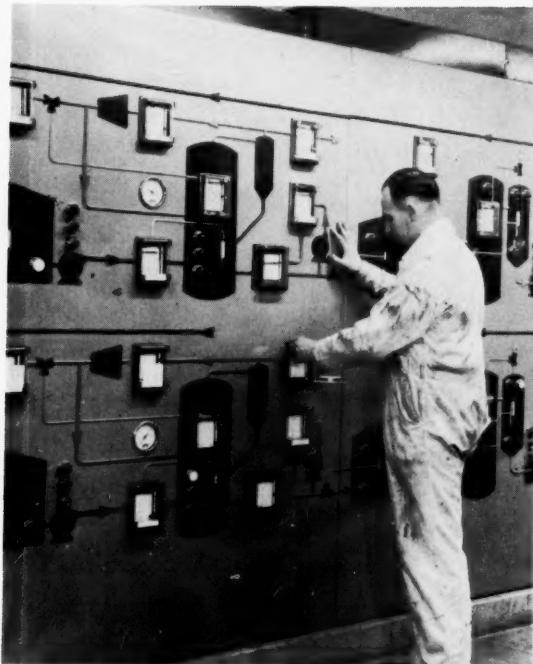
Catalyst particles suspended in the products are retained by a filter system at the base of the hydrogenator. An all-aluminum shell-and-tube exchanger cools the reactant stream before it flows to the exothermic oxidation step.

► **Autoxidation**—The quinol molecule oxidizes non-catalytically in the presence of air to form  $\text{H}_2\text{O}_2$  and the original quinone molecule.

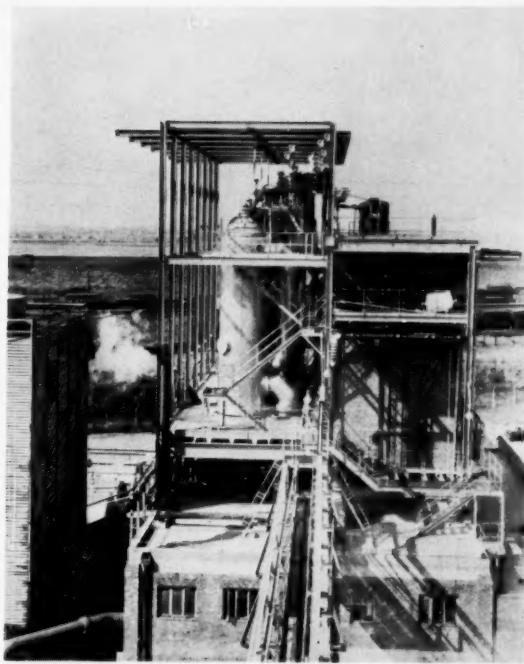
Air and the stream from the hydrogenator flow co-currently up the oxidation tower—an aluminum column 60 ft. tall and 12 ft. dia. Rotary compressor supplies air at 40 psig.

Solvent carried out in the air stream is recovered by adsorbing on activated charcoal in two pairs of vessels in parallel. While one pair is adsorbing, the other pair is being steamed for solvent recovery.

► **And Extraction**—Hydrogen peroxide is extracted from the organic solvent by countercurrent contacting with deionized water.



**CONTROL ROOM** instruments are largely pneumatic because of the flammable nature of streams in the process.



**DISTILLATION COLUMNS** in the Laporte plant, which concentrate the  $H_2O_2$  to 90%, are fabricated from aluminum.

There are three 24-plate extractors in parallel, each 80 ft. high and 9 ft. dia., operating at 60-70F. Peroxide-free solvent flows from the top of the extractors for regeneration and recycle to the hydrogenator. Aqueous stream at the extractor's base contains about 20%  $H_2O_2$  which is washed free of organics and then sent to aluminum tanks for monitoring prior to concentrating.

Design of the extraction columns was a "first" for Laporte engineers: Data for estimating the number of extraction stages required for solvent-water-peroxide system were not in existence when engineers first tackled the job. Finished design represents some pioneering work in the field of liquid-liquid extraction.

► **Final Concentration**—Few details have been released on the technique Laporte uses to concentrate the aqueous peroxide solution, but observers believe it similar to the method used in its older electrolytic  $H_2O_2$  plant.

In the older plant, Laporte employs a two-stage vacuum distillation unit to achieve a final 90%  $H_2O_2$  concentration. But there is the problem of impurity buildup in the first reboiler requiring

shutdown every 4 to 5 days for draining. By adding a vaporizer-separator tandem to the distillation column, Laporte can bleed off impurities continuously without shutdown.

Aqueous  $H_2O_2$  flows to the first vertical shell-and-tube vaporizer; vapor-liquid mixture passes to a separator. Liquid from the separator flows back to the vaporizer permitting continuous bleed of impurities. Vapor is fractionated in a column operating at 40-50 mm. Hg with direct reflux which gives a bottoms of 70%  $H_2O_2$ .

Bottoms from the first column is pumped to another vaporizer-separator set operating with the second column which gives a final  $H_2O_2$  strength around 90%.

► **Using Computer**—During plant design, engineers developed a series of 31 equations to simulate plant streams and fed these data to an analog computer.

Among points established by this investigation were optimum settings of controllers and the fact that no serious interactions would occur between the automatic controls in the completed peroxide unit.

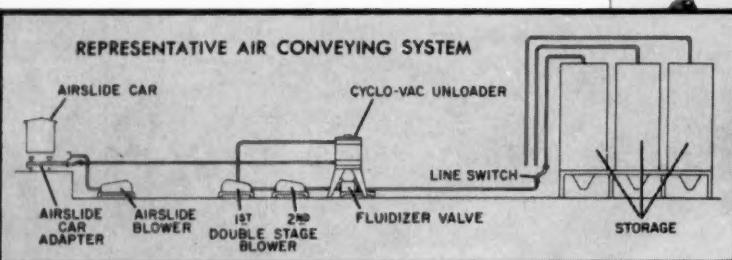
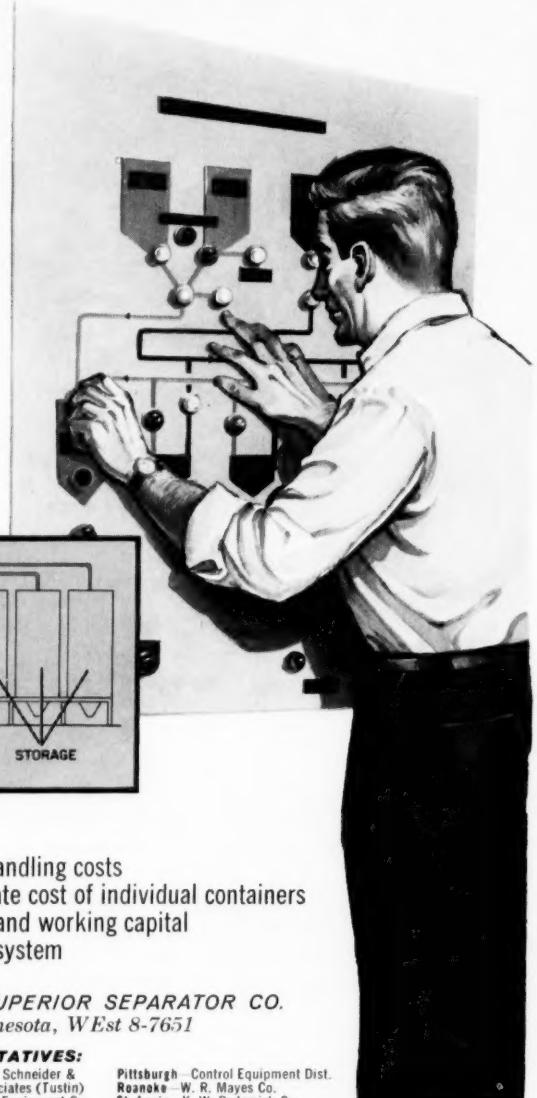


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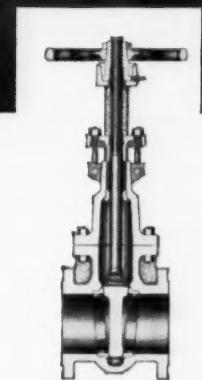
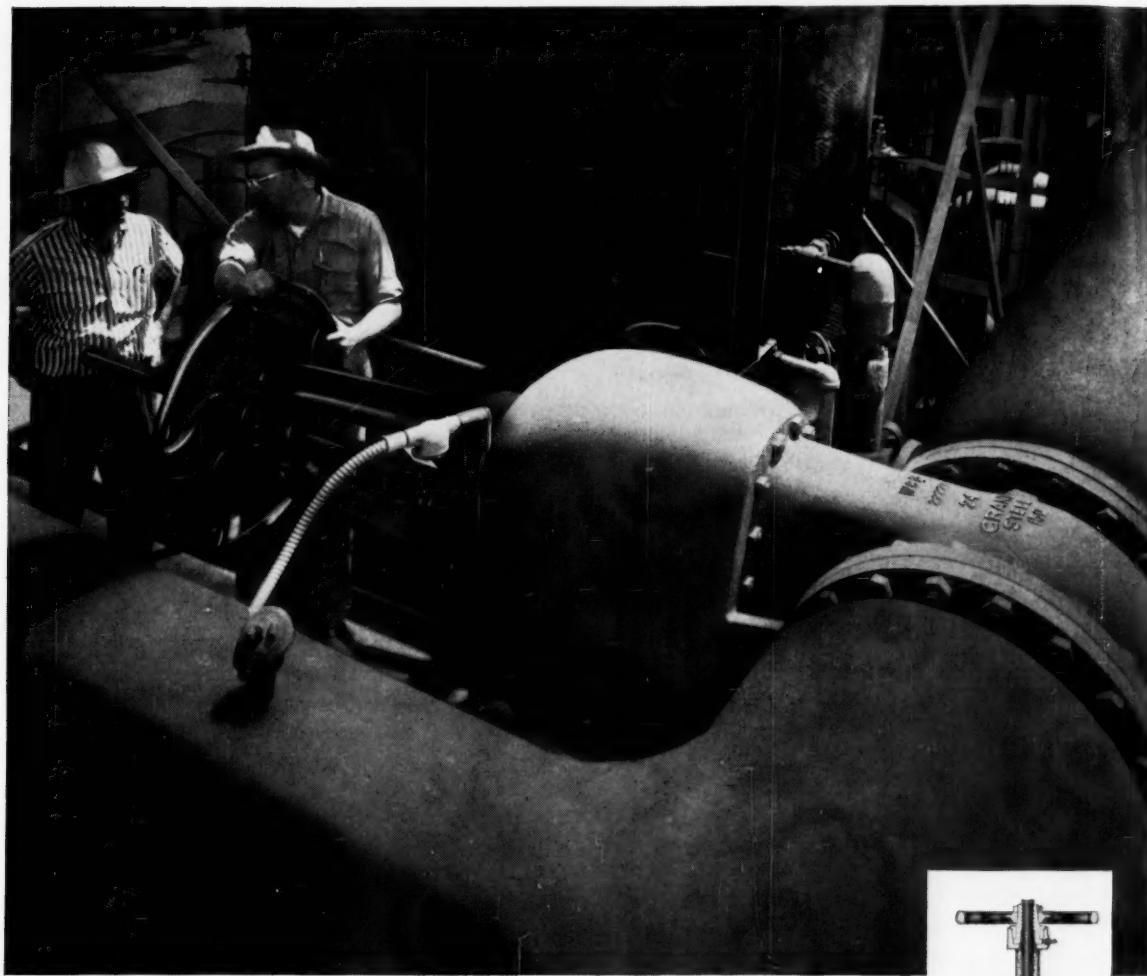
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today, the valve has not developed one leak. Nor has one cent been spent for maintenance. And the big 24-inch, hand-operated valve opens and closes as easily now as it did the day it went into service—17 years ago!

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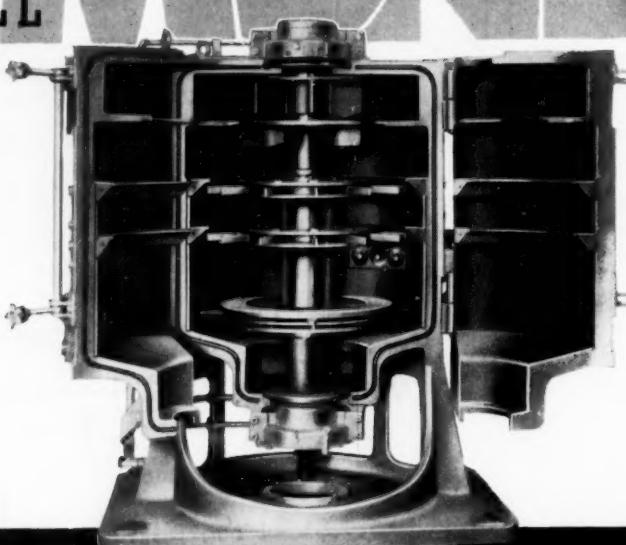
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This Raymond Bulletin #78 gives detailed information on superfine pulverizing operations. Write for your copy.

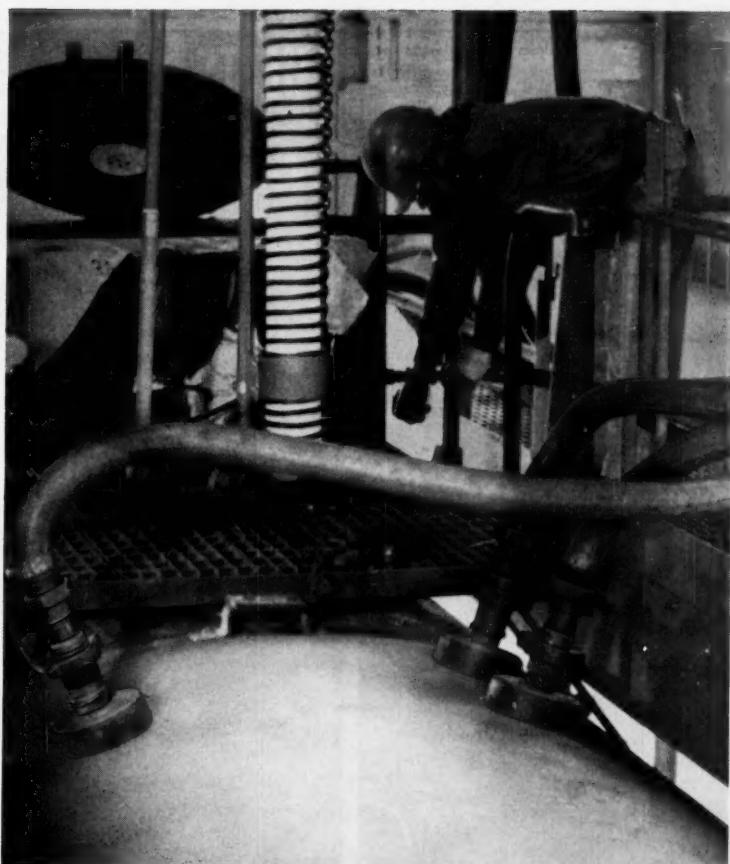
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If you require more reactive forms of sodium, U.S.I. can help you there, too. We can advise on the preparation of sodium sand, high surface sodium and sodium dispersions, and their use in your plant.

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## Use New Graphical Method Find Mass Transfer Units

Easier geometry eliminates integration,  
handles liquid and gas transfer units  
in this new design technique.

OWEN T. HANNA, *Purdue University, Lafayette, Ind.*

FOR MASS transfer calculations, the height  $H$  of a transfer unit concept has been useful. With it, we divide the problem of determining the tower packing height into two parts: finding the height of a transfer unit  $H$ , and finding the number of transfer units  $N$ . Of course, the  $H$  and  $N$  used to calculate the packed height must be based on the same driving force.

Definitions of the number of transfer units for various cases will be found on p. 129. The definitions are general relations, valid when operating and equilibrium lines are either curved or straight.

A rigorous determination of the number of transfer units involves graphical integration. However, we may approximate the integral with considerable accuracy by a new graphical method. This new method uses definitions of graphical  $N$ 's shown on p. 129.

For cooling tower and distillation operations,  $N^{gr} = N$ . For absorption,  $N^{gr}$  differs from  $N$  by the factor  $(1 - y)$  or  $(1 - x)$ , as the case may be. We define the mass transfer coefficient to include inert mean pressure effects, if any. For convenience, consider  $N_a^{gr}$ .

We see that one graphical transfer unit corresponds to a change in  $y$  that is equal to the average driving force causing the change. In other words,  $N_a^{gr}$  may be divided into a number of lesser integrals, each of which is equal to one graphical transfer unit (except possibly the last one which will correspond to a fraction of a graphical transfer unit). The upper limit of each integral is chosen so that the integral (except the last one) corresponds to one graphical transfer unit (see below).

This method of stepwise calculation should not be confused with the McCabe-Thiele method of handling stagewise calculations. This new graphical method simply approximates the integral and in no way implies equilibrium between the bulk streams at any point.

### Graphical Gas Transfer Unit

Let's find  $N_a^{gr}$  for absorption (Fig. 1). First, we locate the gas interface curve ( $x$  vs.  $y_i$ ) by drawing several tie lines that establish the locus  $(x, y_i)$ . A tie line locates the equilibrium interface composition corresponding to any particular passing gas and liquid bulk compositions and has a slope equal to  $-k_{L}a_{\infty}/k_{G}aP$ . Tie lines will be parallel whenever  $k_{L}a$  and  $k_{G}a$  and  $a_{\infty}$  do not vary with composition, but, in general, both coefficients may vary with composition due to the effects of the non-diffusing components and varying mass velocities.

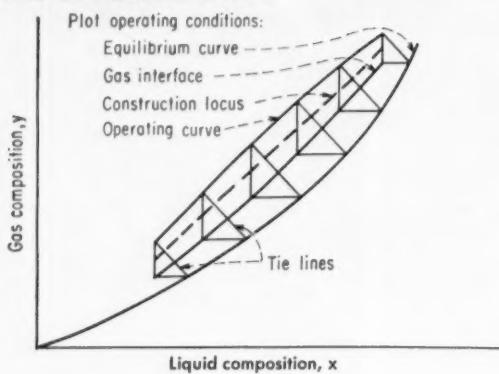
Next, we locate the locus  $[x, (y + y_i)/2]$  of the midpoints of vertical lines connecting the operating and gas interface curves. We'll refer to this curve as the construction locus. It's not actually necessary to construct the gas interface locus—the construction locus can be obtained directly from points located by the various tie lines.

Starting at the bottom of the operating curve,  $A$  in Fig. 1, we draw a horizontal line intersecting the construction locus at  $B$ . We extend the horizontal line a distance equal to  $AB$ , so that  $AB = BC$ . Next we draw a vertical line through point  $C$  that intersects the op-

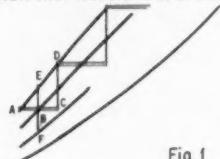
$$\int_{y_i}^{y_2} \frac{dy}{(y - y_i)} = \int_{y_i}^{y_a} \frac{dy}{(y - y_i)} + \int_{y_a}^{y_b} \frac{dy}{(y - y_i)} + \int_{y_b}^{y_c} \frac{dy}{(y - y_i)} + \dots + \int_{y_{\infty}}^{y_2} \frac{dy}{(y - y_i)}$$

## TRANSFER UNITS . . .

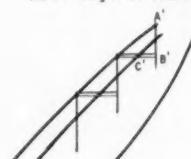
### Find Gas Transfer Units



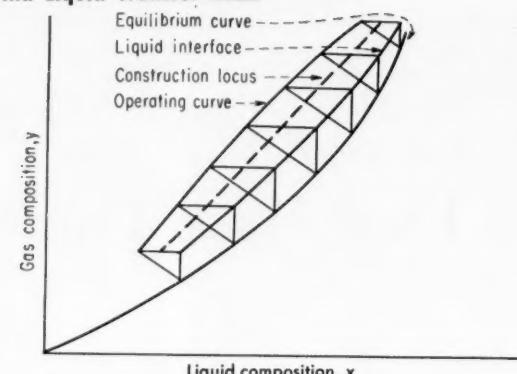
Start first transfer unit at bottom . . .



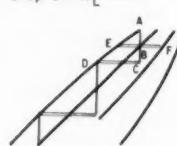
. . . Or begin at the top



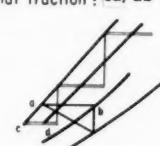
### Find Liquid Transfer Units



Step off  $N_L^{gr}$  . . .



Final fraction:  $cd/ab$



erating curve at point *D*. The change in *y* from *A* to *D* corresponds to one graphical gas transfer unit.

For proof of the construction, we assume that the operating and gas interface curves are straight over the range of a transfer unit.\* Since  $AB = BC$ , by similar triangles  $EB = \frac{1}{2}CD$ . But  $EB = \frac{1}{2}EF$ , where point *F* is on the interface locus since the construction locus determines  $(y + y_i)/2$  for any *x*. Therefore,  $\frac{1}{2}CD = \frac{1}{2}EF$ , or  $CD = EF$ . Since  $CD$  is the change in *y* and  $EF$  is the average driving force causing the change, this step represents one graphical transfer unit.

If we start the calculations at the top of the operating line, we modify the procedure as follows. Starting at *A'*, we draw a vertical line to *B'*. Point *B'* is determined by the condition that a horizontal line through *B'* is divided in half by point *C'*, which is the intersection of the horizontal line with the construction locus. Point *B'* must be determined by trial. This procedure is used to go down the column and determine the total number of gas transfer units.

We use the method outlined above to find the integral number of transfer units. The last fraction of a graphical transfer unit is found by dividing the final change in *y* by the average driving force causing the

change. This is shown graphically in Fig. 2 for liquid transfer units, and is analogous to the gas case.

### Graphical Liquid Transfer Unit

In absorption, the number of graphical liquid transfer units  $N_L^{gr}$  may be found in a similar manner. First, we locate the construction locus of  $(x_i + x)/2$  vs. *y* as shown in Fig. 2. This is done by finding *x* and *x<sub>i</sub>* corresponding to *y* by means of a tie line, and then locating the midpoint of the line connecting *x* and *x<sub>i</sub>*. By doing this for several values of *y*, the construction locus may be drawn. Again we assume that both the operating and equilibrium curves are straight over the

### Nomenclature

<i>a</i>	Transfer area per unit volume of packing.
<i>G'</i>	Mass velocity of dry air.
<i>h<sub>L</sub></i>	Water film heat transfer coefficient in cooling tower.
<i>i<sub>L</sub></i>	Wet air enthalpy in water cooling tower.
<i>i<sub>i</sub></i>	Air interface enthalpy in water cooling tower.
<i>k<sub>g</sub></i>	Gas film mass transfer coefficient based on pressure driving force.
<i>k<sub>s</sub>'</i>	Air film mass transfer coefficient based on humidity driving force.
<i>k<sub>L</sub></i>	Liquid film mass transfer coefficient based on concentration driving force.
<i>P</i>	Total pressure.
<i>x</i>	Bulk liquid composition.
<i>x<sub>i</sub></i>	Interface liquid composition.
<i>x<sup>*</sup></i>	Composition of liquid in equilibrium with bulk gas.
<i>y</i>	Bulk gas composition.
<i>y<sub>i</sub></i>	Interface gas composition.
<i>y<sup>*</sup></i>	Composition of gas in equilibrium with bulk liquid.
<i>ρ<sub>M</sub></i>	Molar liquid density.

\*When we assume that the operating and equilibrium curves are straight over the range corresponding to one graphical transfer unit, this graphical method locates the arithmetic average of  $(y - y_i)$  between values of *y* corresponding to one graphical transfer unit. This average is not quite correct, since when both operating and equilibrium curves are straight over a given range, the correct average value of  $(y - y_i)$  is the logarithmic mean. However, in most cases, the initial and final values of  $(y - y_i)$  corresponding to one graphical transfer unit are sufficiently alike to justify the arithmetic rather than the logarithmic mean. When the initial and final values of  $(y - y_i)$  differ by as much as a factor of two, the arithmetic mean is in error by less than 5%. This also applies when the other driving forces are used.

range corresponding to one graphical transfer unit. In this case it is most convenient to begin at the top of the operating curve.

Starting at *A* in Fig. 2, we draw a vertical line intersecting the construction locus at *B*. We extend the vertical line to point *C* so that  $AB = BC$ . A horizontal line through *C* intersects the operating curve at *D*. This change in *x* corresponds to one graphical liquid transfer unit.

Proof of construction is similar to the gas transfer unit case.

We see that when either the gas or liquid film resistance is controlling, the tie lines are either horizontal or vertical, as the case may be. Then the new method is reduced to essentially the same as that of Baker<sup>1</sup>. Similar to the method of White<sup>2</sup>, the present procedure will be slightly in error if the curvatures of the operating and equilibrium curves are great.

We can determine number of graphical liquid transfer units starting at the bottom of the operating line by modifying the procedure in similar manner to the modification for determining the number of graphical gas units starting at the top of the operating line.

The graphical procedure for stripping is the same as for absorption, except that the calculations are more conveniently begun at the opposite ends of the operating line.

In the special case of the air-water cooling tower system, we may use the enthalpy-temperature diagram for this new graphical technique. In this case, the tie lines relating interface and bulk gas enthalpies have slope  $-h_L a / k'_L a$  and the operating line has slope  $L/G$ . The tower height is the product of  $H_a$  and  $N_a$ , where

### Compare Transfer Units

#### Standard Transfer Units

For absorption:

$$\text{Number of gas transfer units, } N_G = \int_{y_1}^{y_2} \frac{dy}{(1-y)(y-y_i)}$$

$$\text{Number of liquid transfer units, } N_L = \int_{x_1}^{x_2} \frac{dx}{(1-x)(x_i-x)}$$

$$\text{Over-all gas transfer units, } N_{OG} = \int_{y_1}^{y_2} \frac{dy}{(1-y)(y-y^*)}$$

$$\text{Over-all liquid transfer units, } N_{OL} = \int_{x_1}^{x_2} \frac{dx}{(1-x)(x^*-x)}$$

For water-cooling tower:

$$\text{Number of transfer units, } N_i = \int_{i_1}^{i_2} \frac{di_g}{(i_i - i_g)}$$

#### Graphical Transfer Units

$$N_G^{gr} = \int_{y_1}^{y_2} \frac{dy}{(y-y_i)}$$

$$N_L^{gr} = \int_{x_1}^{x_2} \frac{dx}{(x_i-x)}$$

$$N_{OG}^{gr} = \int_{y_1}^{y_2} \frac{dy}{(y-y^*)}$$

$$N_{OL}^{gr} = \int_{x_1}^{x_2} \frac{dx}{(x^*-x)}$$

$$N_i^{gr} = \int_{i_1}^{i_2} \frac{di_g}{(i_i - i_g)}$$

$H_a = G/k'_L a$ . Calculation is conveniently begun at the top of the operating line. Construction is identical with that presented for absorption.

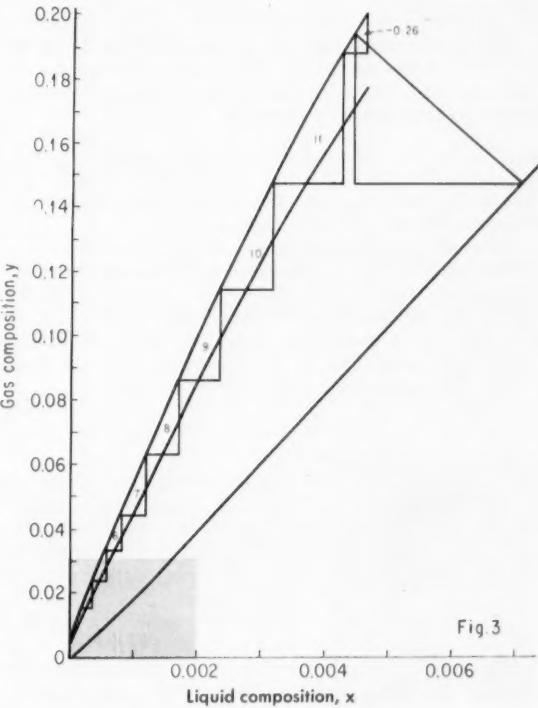
### Actual Transfer Units

As we noted before, number of transfer units is equal to number of graphical transfer units for water-cooling tower and distillation operations. In absorption the two units differ by the factor  $(1-y)$  or  $(1-x)$ . If  $(1-y)$  varies a small amount, an average value for the entire column is satisfactory. However, if  $(1-y)$  varies considerably throughout the column, we should compute the average value of  $(1-y)$  for each graphical transfer unit. Then we divide each graphical transfer unit by its average  $(1-y)$  and the summation of all gives the total number of actual transfer units. The same applies, of course, to variations in  $(1-x)$  for determining  $N_L$ .

### Example

We can compare the adequacy of the new method with the standard procedure of graphical integration. Let's consider an absorption tower design presented in McCabe and Smith ("Unit Operations of Chemical Engineering," McGraw-Hill, 1957, p. 645). A tower packed with 1-in. Raschig rings is to be designed to absorb sulfur dioxide from air by scrubbing the gas with water. The entering gas is 20%  $\text{SO}_2$  by volume ( $y_1 = 0.20$ ), and the leaving gas is to contain not more than 0.5%  $\text{SO}_2$  by volume ( $y_2 = 0.005$ ). The entering  $\text{H}_2\text{O}$  is  $\text{SO}_2$ -free ( $x_1 = 0$ ). The temperature is 30°C.

### Try the Example



## Expand the Pinch

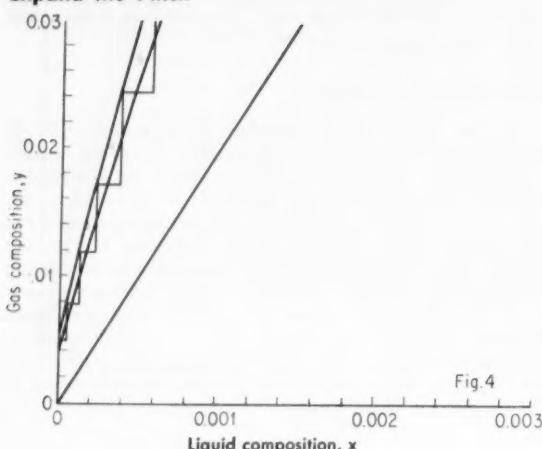


Fig. 4

and the total pressure is 2 atm. The water flow is to be twice the minimum. The air flow rate (SO<sub>2</sub>-free basis) is to be 6.90 moles/(hr.) (sq. ft.). What depth of packing is required?

The following equations are the applicable mass transfer coefficients:

$$k_{L a} \rho_M = 0.152 G_x^{0.28}$$

$$k_{v a} P = 0.028 G_y^{0.17} G_x^{0.28}$$

where  $G_x$  and  $G_y$  are the mass velocities of liquid and vapor, respectively, in lbs./hr. (sq. ft.), based on total tower cross section. The equilibrium curve is shown on the  $x$ - $y$  diagram.

## Solution

The minimum water rate is calculated by using the equation of the operating line passing through points  $(x_b^*, y_b)$  and  $(x_a, y_a)$ . The material balance over the entire column can be written as

$$G_{M_s}' \left[ \frac{x_b}{1 - x_b} - \frac{x_a}{1 - x_a} \right] = G_{M_v}' \left[ \frac{y_b}{1 - y_b} - \frac{y_a}{1 - y_a} \right]$$

where  $G_{M_s}'$  and  $G_{M_v}'$  are the molal mass velocities of SO<sub>2</sub>-free air and of water respectively.

From the equilibrium curve, when  $y_b = 0.20$ ,  $x_b^* = 0.0092$ , and the minimum water rate from the material balance is  $G_{M_s}' = 182$  moles/(hr.) (sq. ft.). Actual water rate is twice the minimum, 364 moles/(hr.) (sq. ft.), and  $x_b$  is calculated from the material balance using this rate. The value of  $x_b$  is 0.00462 or about 0.005. The equation for the operating line is



OWEN T. HANNA is an instructor of chemical engineering at Purdue University. He received his B. S. from Purdue in 1957 and, after working with Linde Co., began his graduate studies. A member of Tau Beta Pi, Hanna is interested in thermodynamics and heat and mass transfer.

$$364 \frac{x}{1 - x} = 6.90 \left[ \frac{y}{1 - y} - \frac{0.005}{0.995} \right]$$

Neglecting  $x$  in the term  $(1 - x)$ ,

$$x = 0.0189 \frac{y}{1 - y} - 0.0001$$

from which the operating line is constructed.

To calculate the mass transfer coefficients, mass velocities of both gas and liquid streams are obtained from the material balances over the tower. The SO<sub>2</sub>-free air flow is 200 lb./hr. (sq. ft.). The SO<sub>2</sub> enters with the gas at 111 lb./hr. (sq. ft.). The SO<sub>2</sub> leaves with the gas at 2 lb./hr. (sq. ft.), and the total exit gas flow is 202 lb./hr. (sq. ft.). The SO<sub>2</sub> is absorbed by the water at 109 lb./hr. (sq. ft.). The water rate fed to the top of the tower is 6,550 lb./hr. (sq. ft.), and the strong liquid rate is 6,660 lb./hr. (sq. ft.).

The liquid resistance does not change appreciably from top to bottom of the tower. The liquid coefficient can be calculated from the average mass velocity of the liquid, which is  $6,550 + (109/2) = 6,610$  lbs./hr. (sq. ft.). Then  $k_{L a} \rho_M = 206$ .

Gas resistance at the bottom of the tower is appreciably greater than that at the top because of the change in  $G_y$ . The quantity  $k_{v a} P$  is calculated for both ends of the packed section and the arithmetic average used as a constant. Thus

$$(k_{v a} P)_b = 14.1$$

$$(k_{v a} P)_a = 10.4$$

The average of these is 12.3. Slope of the tie lines is  $-206/12.3$  or  $-16.7$ . The average value of  $1/H_a = k_{v a} P/G_y$  over the column is 1.56 ft.

## Using Old Method

Intersections of tie lines with the equilibrium curve give values of  $y_i$  corresponding to assumed values of  $y$ . By plotting  $1/(1 - y)$  ( $y - y_i$ ) vs.  $y$ , the value of  $N_a$  may be determined by finding the area under the curve between  $y = 0.005$  and  $y = 0.20$ . This integral is the number of individual gas transfer units. McCabe and Smith have found graphically that the value of the integral is 12.72, and the height of packing 8.15 ft.

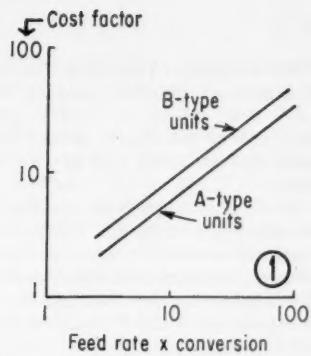
## Using New Method

With the new method, the tedious integration is eliminated. Equilibrium and operating lines are plotted as above on the  $x$ - $y$  diagram. Tie lines establish the construction locus of midpoints of the gas-phase driving force ( $y - y_i$ ). Starting at  $y = 0.005$ , the graphical transfer units are stepped off as shown in Figs. 3 & 4. Construction gives 11 graphical units, plus the final fraction. The final fraction is  $\Delta y/(y - y_i)_{av} = (0.20 - 0.188)/(0.193 - 0.147) = 0.26$ .

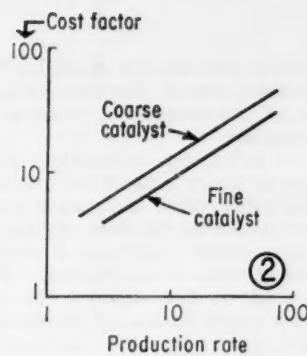
For absorption, the value of  $N_a$  differs from  $N_a''$  by the factor  $(1 - y)$ . Since the value of  $(1 - y)$  does not vary greatly throughout the column, an arithmetic average over the whole column may be used. Thus  $(1 - y)_{av} = (0.8 + 0.995)/2 = 0.898$ , and  $N_a = 11.26/0.898 = 12.54$ . The height of packing using  $N_a$  determined by the new technique is  $12.54/1.56 = 8.04$  ft. This varies from the graphical integration technique by 1.4%.

## REFERENCES

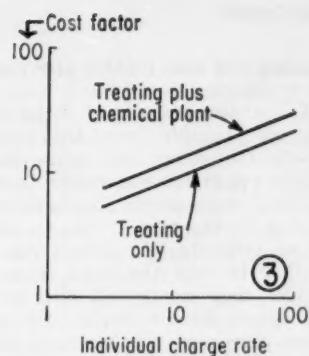
1. Baker, T., *Ind. Eng. Chem.*, **27**, 977 (1935).
2. White, G., *Trans. AIChE*, **36**, 359 (1940).



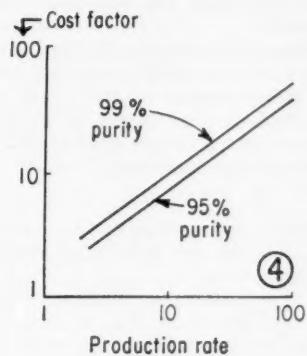
ABSCISSA choice depends on the extent that the major process components are affected.



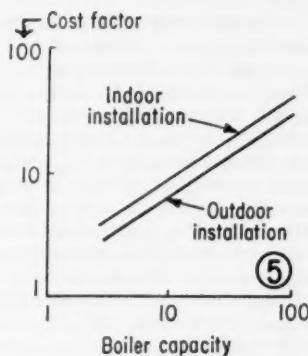
PRODUCTION RATES that depend on various specifications have to be adjusted to one.



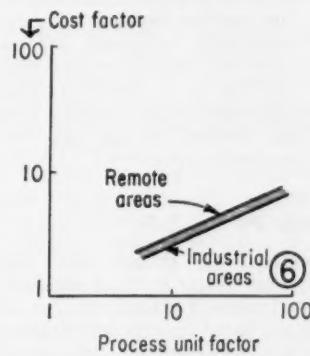
TOTAL FACTOR of multiple-product unit equals the sum of individual product factors.



DIFFERENT PROCESSES for the same product or different products purities affect costs.



PARAMETERS are useful for rating offsites, power plants, indoor or outdoor installations.



EXPERIENCE lets factors such as remoteness be gaged between a pair of cost curves.

## Make Your Own Cost Charts

Here's the answer to your worries on the scarcity of good cost estimating data. Make your own charts and you're sure they're good

**HARRY L. STRICKLING, Chemical Engineer, Dumont, N. J.**

**Y**OU'RE an engineer working for a chemical manufacturer or petroleum refiner; or maybe for an engineer-contractor. You've built a number of chemical plants or refineries over the years; you're planning to build more and you want to know what they'll cost. So naturally . . . you think of the plants you've already built since there's nothing like a record of what something has cost for predicting what something will cost.

But, you find things aren't that easy. The plant you built back in 1953 isn't the same size as the proposed one; it was designed to charge a different stock and yield a product with different specifications. Besides, it had special foundation requirements and was a little gold-plated anyway. To top it off, how much would even the same plant cost today, to say nothing about a year from now when it's proposed to be built.

Perhaps you've tried to escalate the costs of a number of plants of various sizes up to the present and then plotted cost against size on log paper. Interestingly enough, you probably found a pattern of points you could correlate as well by drawing a circle as by drawing a straight line.

Perhaps you drew a line with a slope of six-tenths among the points and then tagged each point and attached a sheaf of notes ex-

plaining why each point is above or below the line.

Well, that's one way of doing it. But, you probably found that even though the chart and notes are clear to you (since you worked them up) they make pretty discouraging reading to the man trying to get out an estimate. He doesn't know whether to read the notes or not because they mostly tell him why the chart doesn't apply. So he either disregards the notes or the whole chart and works up a detailed estimate. This is just what the chart was supposed to keep him from doing. Or, he turns to a published chart that has no notes.

How valid are published charts for your particular case? You're understandably reluctant to use them since you don't know how they were derived or if they're talking about the same thing you are. How are they derived anyway and how can you derive your own?

### Charts Fit the Job

First thing, decide what you want your charts to do. Remember, a chart doesn't substitute for an estimate based on complete detailed design, supplemented by actual quotes of major equipment items. However, it's a reasonably sharp tool, applicable not only for order-of-magnitude estimates for study purposes, but also for estimates upon which appropriations may be based or quotations submitted.

Hone the chart to a degree commensurate with the job it's meant to do, neither too blunt to do an accurate job, not too sharp in comparison with the sketchy information available to the estimator. Therefore, in making your chart, the first rule is: Don't require information to use the chart that the prospective user isn't likely to have at the time he's using it. Also, all information he does have, should be capable of being used.

Now to get specific. The abscissa, or major variable, is a number representing size or capacity. But, is it enough to designate the size merely by a charge rate or a product rate? These are satisfactory for some simple processes and they meet the requirement of being known to the estimator. For other processes, they may not reflect costs accurately enough and therefore some other abscissa should be used. Where a solvent is used in an ex-

traction process, for example, the combined rate of charge stock and solvent will probably be found to be preferable.

For conversion or cracking processes in which some of the original charge disappears and several products appear in its place, neither a simple charge rate nor a simple product rate is satisfactory. Depending on the process, the abscissa might be any of the following:

- Combined charge and recycle rate: charge rate times recycle ratio.
- Catalyst regeneration capacity: coke burning rate, for example.
- Charge rate times conversion: conversion expressed as a fraction of feed disappearance.

Your choice depends on the extent the major components of the process are affected. For example, say a process contains a large reaction or conversion section, a large catalyst regeneration section and a large product separation or fractionation section. The only abscissa that adequately reflects the size of all three is charge rate times conversion. This type of chart is shown in Fig. 1.

To use this chart, the estimator, of course, needs to know the conversion percentage. However, this information should be available at the time an estimate is required.

Production rates themselves depend on product specification. In such cases it's essential that rates based on various specifications be adjusted to apply to a single specification—usually the one most likely to be the basis of future designs. To cover the possibility that future designs may not be based on this specification, provide a conversion table with the chart, so that the estimator can make any adjustments necessary.

For example: Production rate of a given polymer unit depends on the Reid vapor pressure (R.V.P.) specification of the product. Adjust the rate for each unit you are plotting so that a single basis applies to all, say 3.5 psi. R.V.P. Abscissa as shown in Fig. 2 is given as production rate, barrels/stream day (bpsd.). Conversion table reads:

R.V.P., psi	Factor
2	1.02
3.5	1.00
5	0.98
9	0.92
12	0.87

An estimator requiring the cost of a polymer plant to produce, say, 1,400 bpsd. of 12 psi. R.V.P. polymer, enters the chart, not at 1,400 bpsd. but at  $1,400 \times 0.87 = 1,220$  bpsd.

Some plants, such as treating or sweetening plants, are designed to treat either one or several products. In a multiple-product plant, some of the equipment is common to all products and some to each individual product.

This means, a multiple-product plant is somewhat cheaper than two or more single-product plants treating the same total quantity, but more expensive than one single-product plant treating that same quantity.

Here, the slope of the line must first be established by plotting costs of single-product plants. Then, add multiple-product plants by plotting them at a synthetic combined charge rate such that:

$$Q_r^n = Q_1^n + Q_2^n + Q_3^n \dots$$

where  $n$  is the slope of the line and  $Q_1, Q_2, \dots$  are individual product charge rates.

This technique yields a single curve, shown in Fig. 3, that not only applies to single and multiple-product plants alike, but also accounts for differences in ratios between the individual rates for the products in the multiple-product plants.

Offsites are more difficult since designs are less standardized than for process units.

In some units, such as cooling water, power and lighting distribution, the rated capacity, in gpm., or kw., is satisfactory. However, when considerable spare capacity is provided, such as in a stream or electric power plant, the installed capacity rather than the rated capacity, is probably more realistic.

Which to use depends somewhat on company policy regarding spare capacity. If the policy is to provide just a spare boiler or generator and nothing else, you'd better stick with rated capacity, but you're going to have trouble if the spare capacities you are plotting vary greatly, say from 20% to 100%.

If, on the other hand, the policy is to provide spare capacity to the extent that the spare equipment could be operated along with the regular equipment; if, in other words, the spare capacity really represents

overcapacity, then total installed capacity is the proper figure to use.

Capacity of tankage, of course, is total barrels. Yard lines, too, may be correlated by means of total barrels of tankage, since lines serve only to transport process streams from tankage to process unit and back to tankage. Actually, a chart for yard lines is of greater necessity than one for tankage, since tankage may be estimated from individual tanks if a list is available, while no such simple solution is possible for yard lines.

Buildings are a special problem, since they are the least standardized in design and function. Contractors would best not attempt such a correlation since each client probably has different ideas on type, number, size and specifications of buildings.

But, a given refiner probably has a standard complement of buildings, built to certain company standards, that go along with each new refinery. Size of these buildings depends on the refinery's size.

Use a number that represents the size of the refinery as the abscissa of the building curve. This can be the cost of all the process plants in the refinery. Such a figure is known to the estimator since he estimated the cost of the process plants first. It is admittedly not as satisfactory as a direct indication of capacity, as with the utilities and service facilities, but if you understand its limits, it can be almost as useful.

However, a single figure representing size may not cover certain major variations that affect cost. Here, it's necessary to introduce parameters. In this case, each chart consists of two or more parallel curves instead of a single curve. Examples of parameters are: the various processes for producing such chemicals as ammonia, ethylene or urea or the various purities obtainable with any of these processes. This is illustrated in Fig. 4 on the first page.

Other examples are types of crudes for distillation units, types of catalyst for a given catalytic process (Fig. 2) and design severities, as shown by an indication of product quality such as octane or octane number.

For offsites, parameters are also useful. Indoor or outdoor installation is important for power plants

(Fig. 5). For steam power plants, make a division between fire-tube and water-tube boilers and for electric power plants between turbine and diesel drive.

For buildings it's necessary to take account of some factor influencing the extent buildings are provided, even within a given company. Such a factor probably turns out to be the location of the plant or refinery. Location in an industrial area requires smaller buildings than one in a remote area, particularly service buildings such as shops, storehouses, and garages.

Size of administrative buildings, however, such as office buildings, laboratories, cafeterias, etc., is also affected by the nearness of the plant to sources of skilled labor and office help, outside laboratory facilities, and eating places.

It may be necessary to draw not one or two or even three lines, but rather a band, such that the upper edge of the band refers to the remotest areas, and the lower edge to the closest areas, within the experience covered by the chart (Fig. 6). It's up to the estimator using the chart to gage the relative remoteness of the location of the new plant, and to read the chart accordingly.

Another location factor concerns climate. However, this is relatively minor and may simply be superimposed on the remoteness factor, since industrial areas are mostly located in temperature climates.

### Extras are Troublesome

Well now, what about extras, those troublesome items that are added to certain plants and not to others and which throw your costs out of whack? What about feed treaters such as desalters or pre-fractionators and product treaters such as stabilizers, rerun units, and scrubbers? What about piling, substations, unusual spare equipment, extra storage facilities, or unusual drivers such as gas turbines?

Only way to treat such items is to define specifically the scope of your chart and then adjust actual costs of the units to compensate. This, of course, means you will not plot actual costs in every case. Some of the costs are adjusted costs and may involve a bit of estimating themselves.

For example, although it's relatively easy to subtract the cost of

a rerun column and its associated exchangers, vessels, pumps, and even instruments from the total cost of a process plant (assuming that you want the chart without a rerun unit and so state), the cost of piping, foundations, structures, insulation, etc. is more difficult to back out and probably has to be done on a ratio basis.

Of course, select the scope of your chart to require the least amount of such addition or subtraction, both on your part and on the part of the estimator who uses the chart.

### What Dollars to Use

Now we come to the actual figure you'll plot on the ordinate of your chart. This is where many charts fall down because they fail to take into account that costs are changing all the time.

An index is the obvious answer. But which index and how do you use it? To answer the second question first, nothing is easier. Simply divide the cost by the index at the time the cost was incurred. Result isn't a cost but a "cost factor," a factor being defined as one element of a product. In this case, the product is the current cost and the other element, with which the cost factor is multiplied, is the current index.

Numerically, the cost factor is the cost in the base year of the index being used, divided by 100. Since costs of complete units are usually given in thousands of dollars, the cost factor is the base year cost divided by \$100,000. Thus, the cost factor of a \$1,350,000 plant built when the applicable index was 180 is: 7.5.

Advantages of plotting cost factors are as follows:

- There's no question about whether or not the chart is up-to-date. It never is, but, with the current index, it always is.

- Only one index, the current one, is required. But, that one index can't be dispensed with. This is as it should be. Virtue of using a cost factor rather than simply a base year cost is here apparent. Any man using the chart isn't likely to forget that he needs an index when he reads the cost factor of a unit is 7.5, whereas he might if he read that the cost was \$750,000 but missed the fact that this is the 1946 cost.

As to the indexes to use, this, of

course, is very important, although a bit outside the scope of this article. Experiences as to applicability of the various published indexes seem to differ even among companies in the same line of business.

You might try making up your own. This may be better for your purposes than any published index. However, a word of caution. Although a single index probably suffices for all process plants, it doesn't do for the offsites. In fact, many offsite plants require their own indexes because they are often dominated by a single class of material, such as tanks, piping, electric cable, sewer pipe, etc.

Don't lose heart, though. You may be able to synthesize an index using a published process plant index, such as Nelson, along with some of the commodity or group indexes published by the Bureau of Labor Statistics.

### Now for Actual Plotting

Well, now that you know your coordinates, you're ready to plot them on a sheet of logarithmic paper, probably two-cycle each way.

If everything goes according to plan, you ought to get a procession of points going roughly from southwest to northeast. Or maybe two or three processions if you've used a parameter.

If any point is very far out of line, don't be satisfied. There's got to be a reason and you can find it if you dig a little. Here's where a good code of accounts is a big help, as it was back when you were juggling those extras. An extra you missed before, or some field purchases that somehow didn't get included in the total cost of the unit, stand out like sore thumbs and you can take the proper steps to get that point back in line.

Be honest with yourself. Don't push the point into line just because you somehow feel that it ought to be there; because you got a good (or bad) break on that particular job and it'll never happen again. This may indeed be so, but usually it isn't. Usually there's a more concrete reason and it's up to you to find it.

Now to draw the line. Here is where your rigorous approach pays off. You don't have to say that one point is not as good as another, that one is probably a little high and another a little low. Your whole ap-

proach has been toward seeing that each point has equal weight. Now, instead of shifting your triangle around to see how the line looks best, apply what is known as the method of least squares.

Least squares method is ordinarily employed to draw a straight line among points plotted on rectilinear coordinates. When logarithmic coordinates are used the method is revised:

$$y = a + bx \quad (1)$$

$$\log y = \log a + b \log x \quad (2)$$

Substituting the terms from Eq. 2 for the corresponding terms from Eq. 1 into the simultaneous equations used to determine the least squares line on rectilinear paper (see any book on statistics for the derivation of these equations), we obtain

$$n \log a + b \Sigma \log x = \Sigma \log y$$

$$\log a \Sigma \log x + b \Sigma (\log x)^2 = \Sigma \log x \log y$$

where  $n$  is the number of points plotted.

Working out the least squares method requires more time than simply drawing in a line. You'll need four-place log tables and a calculator. Slide rules won't do since you'll be taking small differences between large numbers when you solve those simultaneous equations. Once you get the line, there'll be no questions about it. It's the line, not just the way you or someone else sees it.

A word is in order here about the six-tenths rule. Least squares method gives you both slope and intercept. This means you aren't leaning on the six-tenths rule but relying on your own experience. However, if you have only two or three points, you are in danger of being led astray. In such a case, discretion may dictate you fix the slope at six-tenths and simply determine the intercept by drawing the line midway between the points you have. Or, you may fix the slope at some other figure based on published data or your own experience with similar units.

Rule-of-thumb to remember here is: Plants containing a lot of mechanical equipment are likely to have a slope in the 0.7 to 0.8 range, while a plant consisting mostly of vessels and piping tends to a slope around 0.4 to 0.5.

Also, the inclusion in a plant of equipment whose size is independent of the size of the main capacity determinant of the plant reduces the slope of the curve. For example, if your boiler plants include instrument and yard air-compressors, fuel-oil circulating systems, drinking-water treating facilities, and other items whose size is relatively independent of steam capacity, the slope of your boiler plant curve will be lower than it is otherwise.

Of course, further refinements of the above techniques are possible. You can calculate the mean or standard deviation of the plotted points from the curve and express it as a reliability or confidence coefficient. You can feed the equation of the curve to an electronic data processor for estimating by computer. These refinements are also outside the scope of this article, as are considerations of whether to plot material or erected costs, what to do about escalation, how these techniques may be modified to apply to equipment costs and manhour charts, what sort of backup data to provide with the charts and how to get the cost data in the form you want it.

These questions are largely subjective and don't apply any more generally than those published charts you're trying to avoid using. Purpose of this article is to present a logical, step-by-step procedure for turning raw cost data into useful cost-capacity relationships for complete process and offsite plants.



**HARRY L. STRICKLING** has had many years of experience in this business of cost estimating. Over the years he's worked as a project engineer, cost engineer, design engineer and process engineer. He received a B. Ch. E. in 1944 from C.C.N.Y. and has done graduate work at New York University. Harry was recently elected to the school board in Dumont, N. J.

# Control Valve Construction

How these factors affect performance:

Process fluid properties

Materials of construction

Valve components

Reduced trim

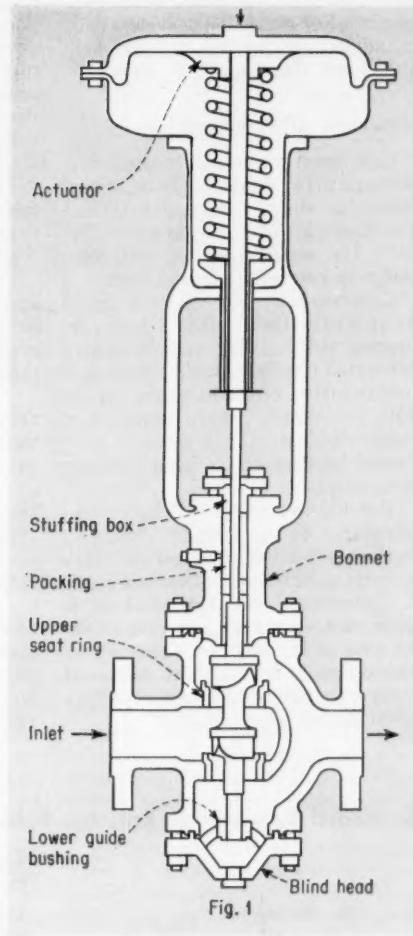


Fig. 1

WERNER G. HOLZBOCK, GPE Controls, Inc., Chicago, Ill.\*

CORROSIVITY, pressure and temperature of the process fluid are dominant factors in selecting materials of construction for control valves. Of course, fluid-flow requirements still govern valve size. Also, valve components, valve trim and valve action on failure have a direct bearing in the final selection of the control valve.

Before going into more details, let's clarify some additional terminology applied to control valves.

As shown in Fig. 1, the valve body is a housing with inlet and outlet flow connections. It may be single-seated in which case it is provided with one seat-ring and one valve plug having one seating surface. It may also be double-seated

like the valve body of Fig. 1 and is then provided with two seat-rings and one valve plug having two seating surfaces.

The bonnet assembly is attached to the valve body. The body stem moves through the bonnet which contains a means for sealing against leakage such as a stuffing box assembly with suitable packing or a sealing bellows. The blind head may be with or without guide bushings.

Typical guide bushings are shown in Fig. 1. The valve plug, in this case, has extensions on top and bottom which are the valve-plug guides. These guides keep the valve-plug motion in alignment. Drain holes connect the space behind the guide bushing with the process fluid. Otherwise fluid could

collect in these pockets and prevent the valve plug from moving. Valve guide bushings are particularly needed in the contoured plug. In the V-port plug of Fig. 1, the cylinder from which the V's are cut out may serve as the guide.

The yoke is the structure which is supported rigidly on the bonnet assembly and carries the diaphragm actuator.

Valve trim consists of those internal components within the valve body which come in contact with the process fluid passing through the valve. Valve trim includes components such as seat rings, valve stems and valve plugs.

Valve bodies are generally cast. Most frequently used materials for valve bodies are cast iron, cast steel and bronze. The kind of process

\*To meet your author see *Chem. Eng.*, March 9, 1959, p. 140.

## CONTROL VALVE . . .

fluid determines what material to use. If corrosion resistance is an important factor, valves can be supplied in almost any metal which can be cast. For corrosion service, typical alloys are stainless steel, nickel, Monel and Hastelloy.

### Materials of Construction

Cast iron is commonly used for noncorrosive fluids and in some cases for slightly corrosive fluids. For example: cast iron is generally used for water service, although water is corrosive on cast iron.

Cast carbon steel is used more extensively than either iron or bronze. It is suitable for use on air, saturated or superheated steam and noncorrosive oils and gases up to 850 F. Where welding-ends are specified, cast carbon steel is preferred because of its good welding properties.

For high-pressure and high-temperature—up to 1,000 F.—service, carbon-molybdenum steel is frequently used instead of carbon steel.

Chrome-molybdenum steel is a good choice for high-pressure steam as well as for oils and gases which become more corrosive at increased temperatures. Also this steel offers good resistance to erosion.

Stainless steels, generally Types 304 and 316, are used for a number of corrosive fluids. Type 316 is a favorite in highly corrosive applications. Annealing should be specified for Types 304 and 316 to take full advantage of their corrosion-resistant properties. Type 304 is also suitable to -300 F.

Cast bronze is used for steam, air, water and noncorrosive gases. Certain dilute acids and oils at limited temperatures can also be handled.

Other valve materials are:

- Nickel for reducing solutions and strong concentrations of hot caustic soda and other alkaline or neutral salts. Not desirable where strong oxidizing agents are present.

- Durimet 20 for any concentration of sulfuric acid at room temperature, or similar highly oxidizing conditions.

- Monel for alkalis, salt solutions, food products, organic substances and many of the air-free acids. Preferred for reducing rather than oxidizing conditions.

- Hastelloy B for mineral acids of extremely corrosive nature. Used successfully with hydrochloric, phosphoric and sulfuric acids and wet hydrogen chloride gas. Not recommended for oxidizing agents.

- Hastelloy C for free chlorine or acid solutions of ferric and cupric salts. Withstands strong oxidizing agents.

An important point to determine is the pressure and temperature at which the valve is to be used. For standard body ratings of various alloys, see Table I.

Smaller valves, 2-in. or less, are usually of the screw-end type. On larger valves, flanged ends are most common. With flanged ends better connections can be made and the valve can be readily removed when necessary.

Dimensions of flanged-end valves have been standardized by the Instrument Society of America as shown in Table II. Hence, a valve can be removed and replaced by another valve of the same size from almost any manufacturer without any change in piping.

With cast iron and steel valves the bonnet and blind heads are fabricated from carbon steel bars or steel forgings.

For valve seats and plugs, stainless steel is generally used. However, in specifying this material, it is not sufficient to consider only corrosive conditions or pressure-temperature limitations, but also pressure drops, erosive conditions and wire-drawing. Wire-drawing refers to the scratching of the metallic surface of the valve by the fluid passing through at high velocity. Steam is a particularly serious offender in this respect.

Clean fluids with pressure drops of 200 psi. or less can be successfully handled with Types 304 or 316 stainless. However, where serious abrasion is present such as in slurries or dust-bearing gases, pressure drops of 50 psi. or less can wear an untreated stainless steel surface surprisingly fast. Furthermore, the maximum temperature at which stainless steel should be used is about 750 F. because its hardness becomes seriously affected.

For example: Type 440-C stainless steel can be surface hardened to give a hardness of approximately Rockwell C-55. The surface then has excellent erosion resistant properties and is suitable for high pressure drops.

About the hardest surface available is Stellite. This finish is a special nonferrous alloy of cobalt, chromium and tungsten. Hardness of this alloy is not materially affected by heat up to 1,500 F. Stel-

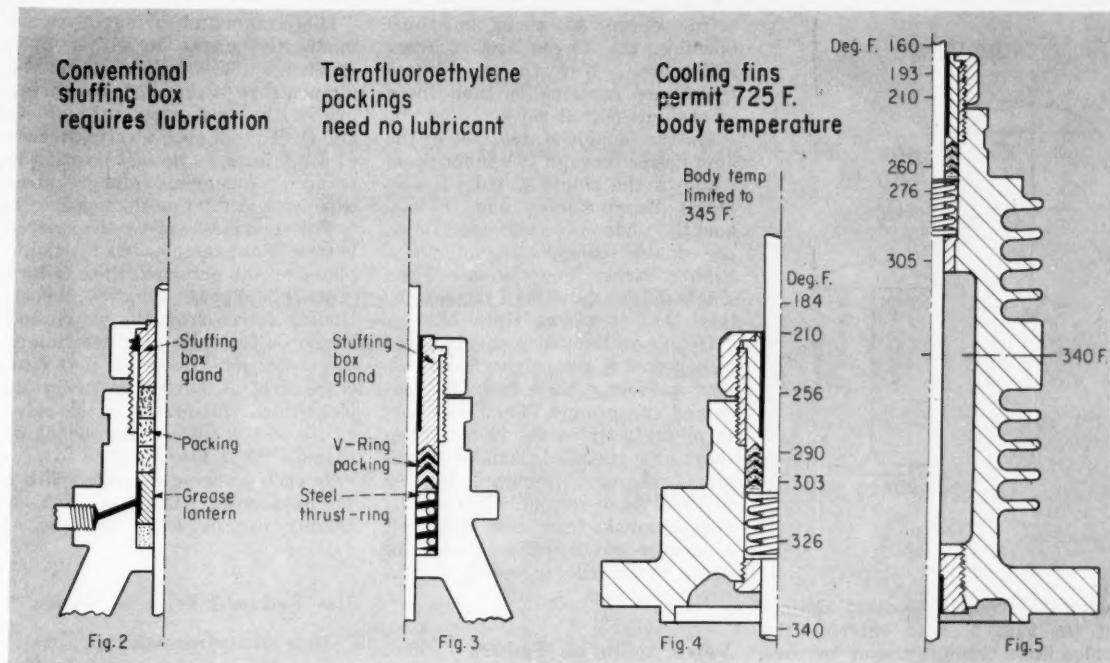
### Standard Valve Body Ratings—Table I

	Pressure, Psi.	Maximum Temperature, ° F
Cast iron, flange-end	125	366
Bronze or cast iron, screw-end	150	366
Cast carbon steel or cast stainless steel, flange-end	150	500
Cast iron, screw- or flange-end	250	410
Bronze	300	466
Cast carbon steel or cast stainless steel, flange-end	300, 400 or 600	800

### Valve Flange Face-to-Face Dimensions—Table II

Pipe Size, In.	Face-to-Face Dimension,* In.			
	125-Psi. Iron	250-Psi. Iron	300-Psi. Steel	600-Psi. Steel
150-Psi. Steel				
1	7 1/4	7 3/4	8 1/4	
1 1/2	8 3/4	9 1/4	9 7/8	
2	10	10 1/2	11 1/4	
2 1/2	10 7/8	11 1/2	12 1/4	
3	11 3/4	12 1/2	13 1/4	
4	13 7/8	14 1/2	15 1/2	
6	17 3/4	18 5/8	20	
8	21 1/8	22 1/8	24	

\*ISA, "Recommended Practice RP-4.1."



lite parts may be solid. Frequently, Stellite is welded onto the wearing parts of seats, plugs, guide-bushings and valve-plug guides. Stellite is unaffected by most common chemicals.

Other materials that resist abrasive conditions are chromium carbide and tungsten carbide.

Bronze is used in low-pressure service where stainless steel may corrode. In cases where the valve body consists of special materials such as Durimet 20, Monel, nickel or Hastelloy, trim parts are usually made of the same material.

### Valve Packings

Stuffing box assembly is capped with either a nut as shown in Fig. 2 or with a flange. Packing is tightened by turning down on the stuffing box nut or, in the case of a flange, by turning down the nuts on the bolts which bear down on the flange. In stuffing boxes with springs like the Teflon V-ring packing in Fig. 3, the nut can be tightened all the way, since the spring provides the proper force.

However, where springs are not provided, as in the graphited pre-formed packing in Fig. 2, the nut

should be finger-tight only. Do not attempt to eliminate leakage by further tightening. If leakage is excessive, lubricant must be added or packing must be replaced or the stem is scratched. Unless seriously objectionable, slight leakage is recommended because it often assures a freely operating valve.

Practically all packings, except those of pure Teflon, require lubrication to reduce friction between packing and valve stem. A lubricator with isolating valve and lubricant ring or grease lantern distributes lubricant through the packing as shown in Fig. 2.

Graphited asbestos rings have been largely replaced by Teflon and some special combinations. Teflon's greasy texture provides a practically frictionless surface and requires no additional lubrication.

However, Teflon has very poor resiliency. When used as a solid ring, this characteristic prevents it from providing a seal unless compressed to a point where friction becomes excessive. V-rings as shown in Fig. 3 provide satisfactory service and are extensively used.

Teflon may also be used in combination with asbestos. This Teflon-asbestos combination consists of

pure long fibers of woven asbestos impregnated with Teflon and woven into rings. Teflon is useful at temperatures up to 500 F. When higher temperatures occur, cooling fins are generally necessary.

For a comparison of the performance of valves with and without cooling fins, see Figs. 4 and 5. Fins built into the bonnet offer as much air-cooled surface as possible between the valve body and the packing. Temperature readings shown in Figs. 4 and 5 were obtained from laboratory tests of the Fisher Governor Co.

Valve-body temperature of the valve without fins was about 345 F. For this case a packing temperature of 303 F. was measured. Hence, a cooling effect of 42 F. occurs between body and packing. However, for the valve with cooling fins, valve-body temperature was 725 F. Temperature at the packing did not rise above 260 F. Therefore, cooling effect is 465 F. or more than ten times that of the conventional valve.

### Valve Seating Arrangements

A double-seated valve has the advantage that one plug always moves

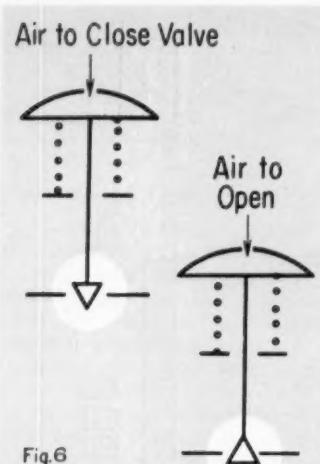


Fig. 6

with the stream, the other against it. In Fig. 1, fluid entering the valve flows through the upper port, pushing upward against the upper plug. It also flows through the lower port, pushing downward against the lower plug.

Construction of double-seated valve is such that the upper port is  $\frac{1}{8}$  to  $\frac{1}{4}$  in. larger in diameter than the lower port. This permits easier assembly, since the lower plug slides through the upper seat ring. This design is frequently referred to as a semi-balanced construction.

Unbalance of forces in the closed position is due to the pressure drop, existing under these conditions, across the valve and the area difference between the two ports. Even in the semi-balanced valve, this unbalance is negligible.

However, there are dynamic forces\* which are active in all other valve positions. These forces depend on valve design and mass velocity of the process fluid. The forces act either as torsional forces which tend to rotate the valve plug like an impeller, or as thrust in a vertical direction.

Torsional forces are particularly pronounced with V-port plugs. These plugs have generally negligible thrust forces. However, contoured plugs are practically free from torsional forces but show thrust forces which reverse in direction when the valve is about two-

thirds open. At about one-third opening, the forces are at their maximum. Nevertheless, these forces are far smaller than those of a single-ported valve.

In the double-seated valve the fluid moves through two inner ports while in the single-seated valve it moves through only one. Consequently, under the same conditions, the double-seated valve allows a slightly larger flow. However, the single-seated valve has the advantage that it allows tight closing.

Double-seated valves should never be expected to close tight, no matter how perfectly they may be machined and ground. They may perform perfectly in the shop. When they are installed, small dimensional changes produced by the process fluid temperature usually suffice to make them leak. However, a double-seated valve should be given preference, unless tight closure is required.

#### Valve Action on Failure

A valve may open, close or remain in its last position when the actuating power fails. The diaphragm-and-spring valve either opens or closes when the air-pressure signal from the controller fails. This generally depends on the position of the valve plug as shown in Fig. 6.

As a safety measure, many processes require that the valve either opens or closes on air failure. For example: on a steam line it can be very dangerous if the valve opens on air failure because the valve then supplies a maximum of steam to a process which is no longer under control. Therefore, before installing a valve, it is very important to determine whether the valve opens or closes on failure and if the particular action is suitable for the process.

A valve which opens on air failure is called an air-to-close or direct-acting valve. Closing on air failures means an air-to-open or reverse-acting valve. In general, an air-to-close valve can be converted into an air-to-open valve by inverting the plug and seat-rings.

Some valves are so designed that air can be connected above as well as below the diaphragm. In this case, to reverse the action of the valve requires only changing the air connections and readjusting the tension of the valve spring.

Diaphragm-and-spring valves are inherently suited to either open or close on air failure. Once the air pressure is removed, the spring pushes the valve stem through its travel. To lock such a valve, in case of air failure, in its last position is rather cumbersome and requires expensive locking mechanisms.

For springless valves, the reverse is true. For example: if a hydraulic piston is the actuator, then failure of hydraulic power removes all positioning forces from the piston and thrust on the valve plug determines valve position. However, it is easy to provide an automatic hydraulic lock which will maintain the valve in its last position independent of thrusts. It is also possible to provide such a springless valve with a mechanism to assure opening or closing of the valve in case of failure.

#### Use Reduced Trim in Valves

It is not infrequent that a valve has to be sized for a certain flow with provision for a planned increase of two or three times in the original flow capacity of the line at some later date. Under such conditions the valve may at first operate under conditions for which satisfactory control cannot be obtained with a valve that also satisfies future needs. In these cases, valves with reduced trim are used.

Reduced trim simply means the substitution of the standard plug and seat-rings by a smaller set. This substitution gives the necessary reduction in capacity while retaining the full, nominal body size.

After installation, a control valve is sometimes found to be oversized. Frequently, it is easier and more economical to exchange the plug and seats than to replace the entire valve. Reduced trim also finds application where high pressure drops or other conditions require great mechanical strength. It is customary to use 1-in. valve bodies for valves smaller than 1-in. and simply provide plug and seats for the smaller pipe size.

Reduced-trim valves may also facilitate installation. Usually, control valve sizes are smaller than pipe sizes and hence, require reducing connections. By using reduced trim, it is frequently possible to use a valve body equal to pipe size and thus eliminate reducing connections.

\*C. F. King and G. F. Brockett, "Dynamic Force Reactions in Double-Ported Valves," ASME Paper No. 51-SA-1, 1951.

## How to Estimate Engineering Properties

Seven Answers From One Chart . . .

# Physical Properties of Water

For the first time, all in one place . . .

Density

Heat of vaporization

Heat capacity

Surface tension

Thermal conductivity

Viscosity

Prandtl number

**WALLACE R. GAMBILL, Union Carbide Nuclear Co., Oak Ridge, Tenn.**

We present in this article a chart which gives the physical properties of water pertinent to heat transfer design. The chart covers the range from 0-340 C. We have found this chart to be rather convenient since it eliminates the necessity of searching through separate tables, graphs and nomographs to get values.

Properties given are liquid density,  $\rho_L$ , in lb./cu. ft.; latent heat of vaporization,  $\Delta H_v$ , in Btu./lb.; liquid heat capacity at constant pressure,  $C_p$ , Btu./(lb.) ( $^{\circ}$ F.); surface tension,  $\sigma$ , expressed in dynes/cm.; liquid thermal conductivity,  $k$ , Btu./(hr.) (ft.) ( $^{\circ}$ F.); liquid viscosity,  $\mu$ , in centipoises; and liquid-phase Prandtl number,  $N_{pr}$ , which is equal to  $c_p \mu / k$ .

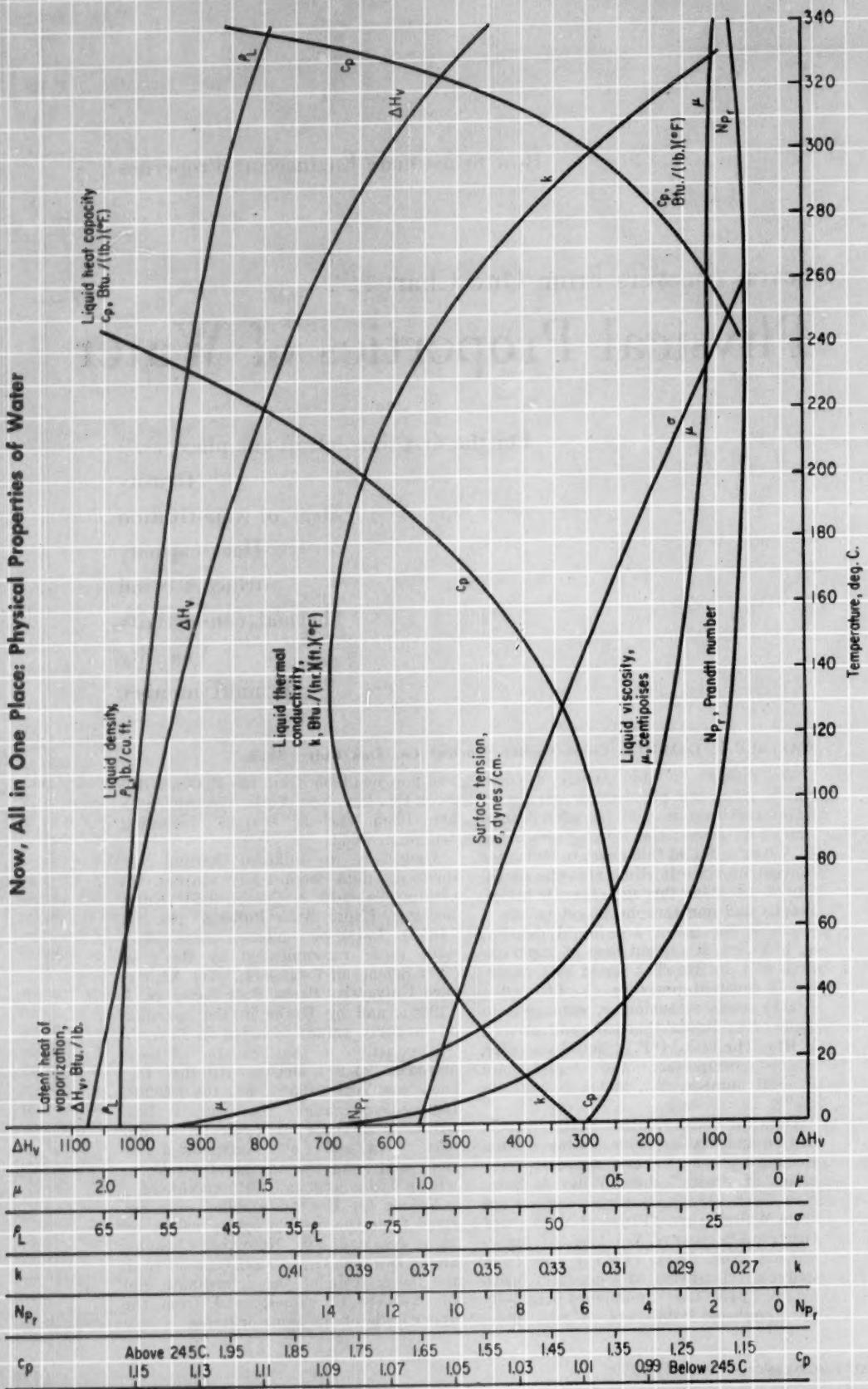
Data for density, latent heat of vaporization and heat capacity are taken from Keenan & Keyes, "Thermodynamic Properties of Steam," John Wiley & Sons, New York (1936). Surface tensions are from Weissberger, "Physical Methods of Organic Chemistry," Vol. I, p. 163, Interscience, New York (1945); and from Lange's "Handbook of Chemistry," 8th Ed., p. 1,615 (1952), published originally by Handbook Publishers, Akron, Ohio,

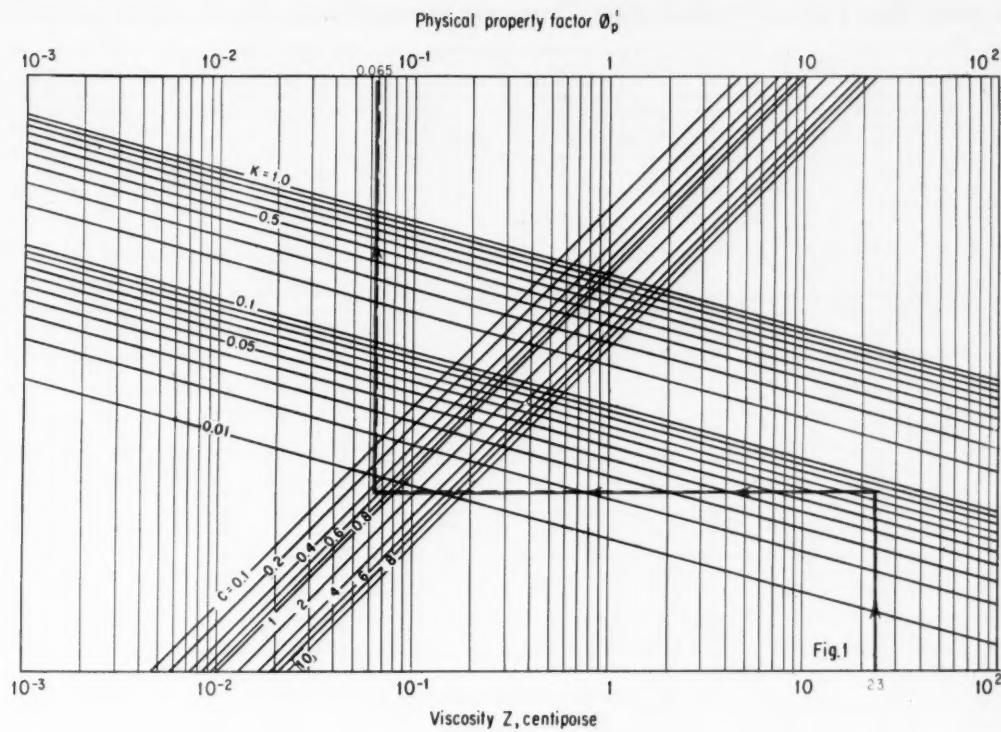
and now available from the McGraw-Hill Book Co., Inc., New York. Viscosity data are from various sources, including Lange, p. 1,632.

Originally we obtained thermal conductivity data from many sources, including Sakiadis & Coates, LSU Engineering Expt. Sta. Bulletin No. 34 (1952). Later we compared these values with those recommended by Beale in "The Science of Petroleum," Vol. XI, Oxford University Press, Fair Lawn, N. J. (1938), and by Drake in the appendix on property values included in Eckert's "Introduction to the Transfer of Heat and Mass," p. 271, McGraw-Hill Book Co., Inc., New York (1950). For the 0-300 C. temperature range, the present data agree with those of Beale to within 0.58% avg. and 1.8% maximum deviation; and with the values of Drake to within 0.51% avg. and 1.0% maximum.

Values for Prandtl number were derived from the basic property values by using  $N_{pr} = c_p \mu / k$ . Note that  $c_p$  values are on two scales: for 0-245 C., read from the lower scale of the  $c_p$  ordinate and for 245-340 C. values, read from the upper scale of the same ordinate.

## Now, All in One Place: Physical Properties of Water





## For Shell-Side Fluids

# Heat Transfer and Pressure Drop

... in Transverse Finned Shell-and-Tube Exchangers

NING HSING CHEN, Heat Transfer Div., The M. W. Kellogg Co., Jersey City, N. J.\*

Transverse fins in shell-and-tube heat exchangers find wide acceptance for heating and cooling of process fluids. Use these charts to evaluate quickly shell-side heat transfer coefficients and pressure drops in transverse finned shell-and-tube heat exchangers.

Calculations for traverse fins follow the general methods established for bare tube exchangers [*Chem. Eng.*, Oct. 20, 1958, pp. 153-156] except for a modification in tube diameter. We use an equivalent diameter  $D_e'$  for the finned-tubes instead of nominal diameter  $D_e$  for the bare tubes.

### How to Find Heat Transfer Coefficients

Find the heat transfer coefficient for a fluid flowing at 100,000 lb./hr. through a 19½-in. I.D. shell containing 292 steel finned-tubes 4-in. O.D.  $\times$  16 BWG. Each tube is 16-ft. long and has 19 fins/in.  $D_e' = 0.739$  in. and  $D_e = 0.66$  in. Tubes are arranged in ½-in. tri-

angular pitch with 20% baffle cutout and 4.5-in. baffle spacing.

At the average operating temperature, properties of the fluid are:  $C = 0.5$  Btu/(lb.) ( $^{\circ}$  F.);  $k = 0.081$  Btu/(hr.) (sq. ft) ( $^{\circ}$  F./ft.);  $Z = 23.0$  centipoise and specific gravity = 0.8.

**Step 1**—Find the physical property factor  $\phi'$  from Fig. 1. Erect a line through  $Z = 23$  to meet the  $k$  line which is 0.081. Then, move horizontally to meet the  $C$  line which is 0.5. Abscissa of this last intersection is shown on top scale as  $\phi' = 0.065$ .

**Step 2**—Calculate the geometric mean mass velocity  $G_e'$ . In Donohue's method,<sup>2</sup> cross flow area equals difference between horizontal diameter and space occupied by the tubes along this diameter times the baffle spacing. Also, baffle opening flow area equals cutout area of baffle less area of tubes passing through cutout area. For this problem, crossflow area is 0.21 sq. ft. and baffle opening flow area is 0.248 sq. ft.

Hence, crossflow mass velocity,  $G_e' = 100,000/(0.21)$

\*To meet your author, see *Chem. Eng.*, June 30, 1958, p. 140.

## Chart Gives Heat Transfer Coefficient for Transverse Finned Tubes

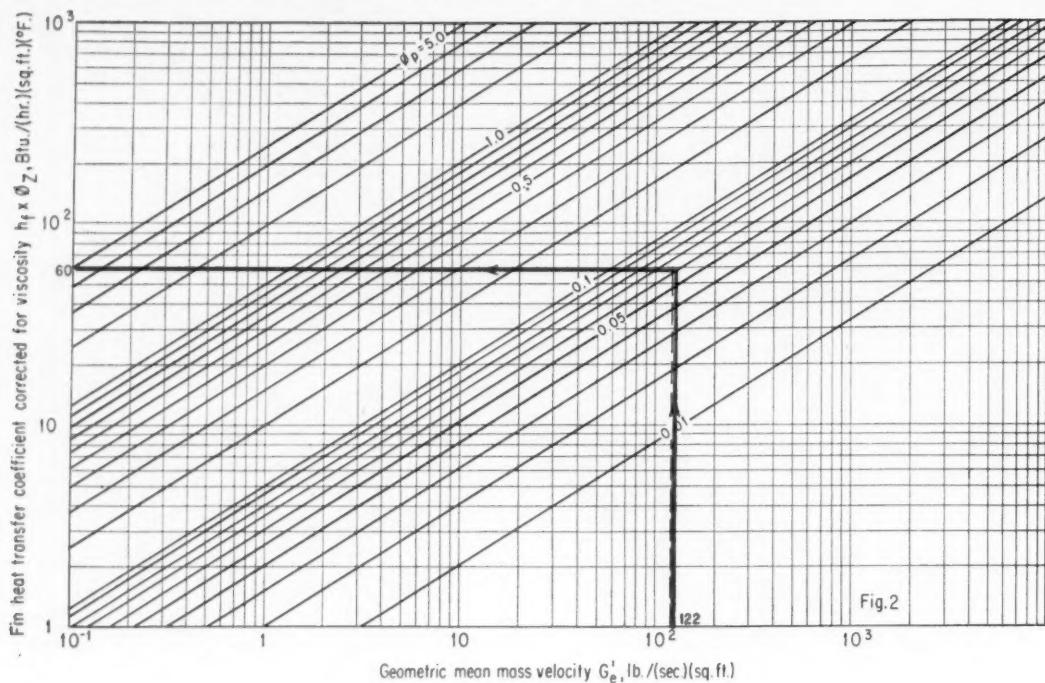


Fig. 2

## Equivalent Diameter Correction Factor for Finned Tubes

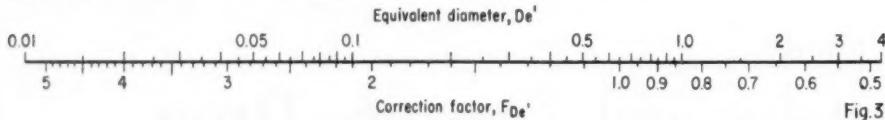


Fig. 3

(3,600) or 132 lb./sec. (sq.ft.); and mass velocity through baffle opening,  $G_e' = 100,000/(0.248)(3,600)$  or 112 lb./sec. (sq.ft.). Then  $G_e' = (G_e' G_b')^{0.5} = 122$  lb./sec. (sq.ft.).

Step 3—Find the heat transfer coefficient corrected for viscosity from Figs. 2 and 3. Erect a line through  $G_e' = 122$  found in Step 2 to meet the physical property factor  $\phi_f' = 0.065$  found in Step 1. Ordinate of this intersection is shown on the left-hand scale as 60. Multiply this value by the equivalent diameter correction factor which equals 1.00 from Fig. 3. The result is  $\phi_f' \times h_f' \times F_{D_e'} = 60 \times 1.00 = 60$  Btu/(hr.) (sq.ft.) (°F.).

## Find Pressure Drop for Streamline Flow

Find the pressure drop for the fluid flowing through the shell under the same conditions as the previous problem.

Step 1—Using the value for  $G_e'$  found in Step 2 of previous solution, draw a horizontal line through 132 on Fig. 4 to meet the vertical line drawn through  $Z = 23$ . Through this intersection, draw a line at  $45^\circ$  to meet the horizontal line drawn through specific gravity

of 0.80. Abscissa of this last intersection is shown on the top scale as 0.0009. Dividing this value by  $D_e' = 0.66$  gives pressure drop as 0.0136 psi. per row of tubes per cross. There are 16 rows and 39 crosses. Therefore  $\Delta P_e' = 0.0136 \times 16 \times 39 = 8.5$  psi.

Step 2—Find the pressure drop through the baffle opening from the author's previous chart.<sup>1</sup> The result is  $\Delta P_e'/N_r = 0.0555$  psi. Therefore,  $\Delta P_e' = 0.0555 \times 38 = 2.1$  psi.

Step 3—Calculate the shellside pressure drop.

$$\Delta P_s' = (\Delta P_e' + \Delta P_b') \times \text{Safety factor}$$

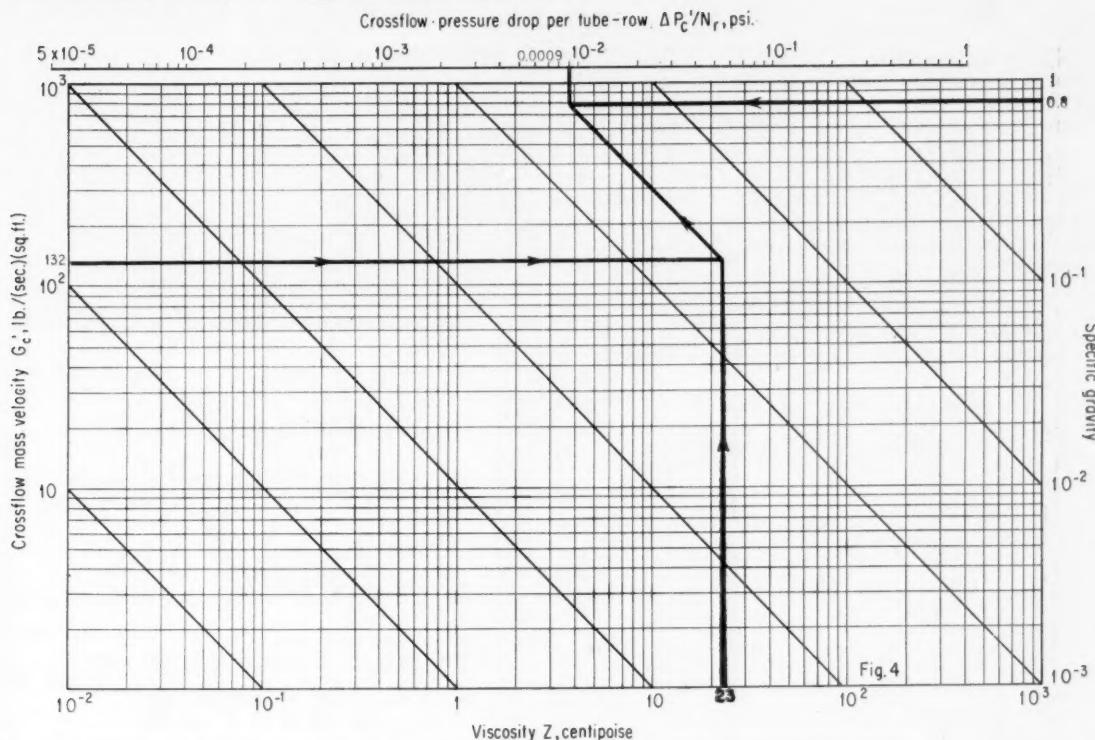
$$\Delta P_s' = (8.5 + 2.1) \times 1.2 = 12.7 \text{ psi.}$$

## Find Pressure Drop for Turbulent Flow

Find pressure drop through the shell under the same conditions as the first problem except viscosity at average fluid temperature is 2.3 centipoise.

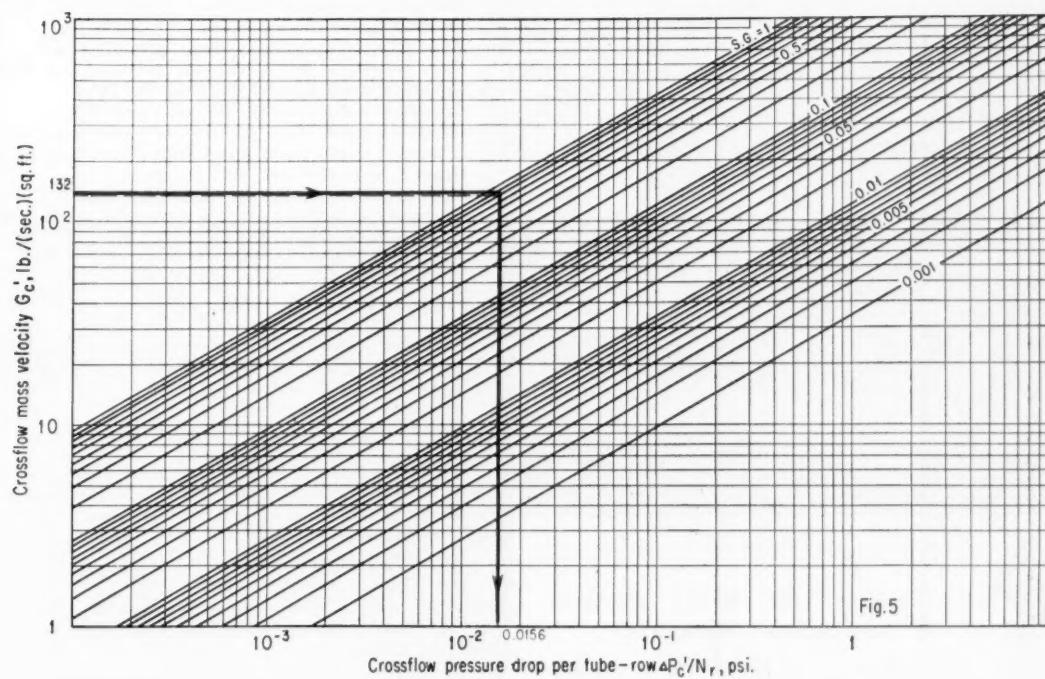
Step 1—Find the pressure drop per row of tubes from Figs. 5 and 6. On Fig. 5, draw a horizontal line through  $G_e' = 132$  to meet the specific gravity line of 0.8. Abscissa of this intersection is shown on the bottom scale as 0.0156. Multiply this value by the correction factor from Fig. 6. For  $Z/D_e' = 2.3/0.66 =$

## Find Shell-Side Pressure Drop for Streamline Flow



Note: Divide crossflow pressure drop  $\Delta P_c'/N_r$  by equivalent diameter of fin-tube  $D_e'$  to find actual pressure drop per tube-row

## Find Shell-Side Pressure Drop for Turbulent Flow



3.48, correction factor equals 1.28. Since there are 16 rows and 39 crosses,  $\Delta P_s' = 0.0156 \times 1.28 \times 16 \times 39 = 12.4$  psi.

Step 2—Pressure drop through the baffle opening remains the same as previous example. Hence  $\Delta P_b' = 2.1$  psi.

Step 3—Find the shellside pressure drop.

$$\Delta P_s' = (\Delta P_e' + \Delta P_b') \times \text{safety factor}$$

$$\Delta P_s' = (12.4 + 2.1) \times 1.2 = 17.4 \text{ psi}$$

Katz,<sup>3</sup> Newell,<sup>4</sup> and Wolverine Tube Division<sup>5</sup> correlate experimental data by using Donohue's method.<sup>2</sup> They use the following equation for heat transfer coefficient:

### Correction Factor for Viscosity and Diameter

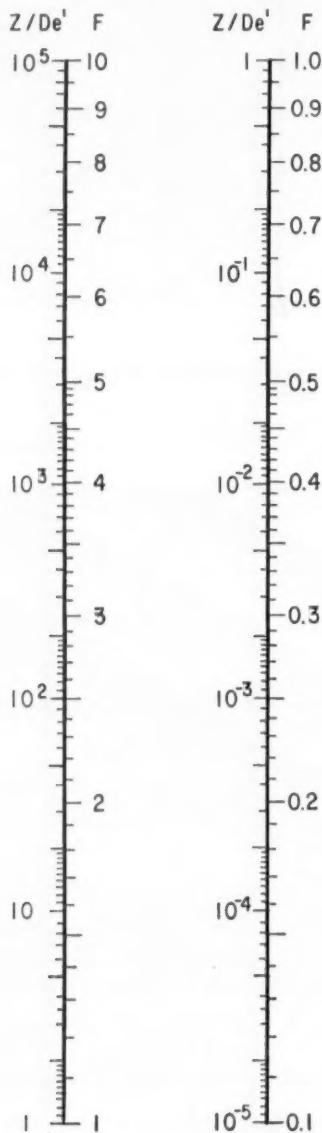


Fig. 6

$$\frac{h_f D_s}{k} = 0.155 \left( \frac{D_s G_s}{\mu} \right)^{0.6} \left( \frac{C \mu}{k} \right)^{1/2} \left( \frac{\mu}{\mu_w} \right)^{0.1} \quad (1)$$

In engineering units, we can write Eq. (1) as

$$\phi_Z h_f = 44.7 \frac{(G_s)^{0.6}}{(D_s)^{0.4}} \phi_p \quad (2)$$

where  $\phi_Z$  is the viscosity correction factor due to tube-wall temperature effect and  $\phi_p$  is the physical property factor. Use Eq. (2) to construct Figs. 1, 2, and 3.

To calculate pressure drop for streamline flow and  $P'/D_s' = 1.25$ , use the following equation:<sup>2</sup>

$$\Delta P_e' = \frac{2.34 \times N_r G_s' Z}{10^6 \times D_s' S.G.} \quad (3)$$

When  $P'/D_s' = 1.33$ , take 75% of the pressure drop calculated by Eq. (3). To make Fig. 4, use Eq. (3).

For turbulent flow and  $P'/D_s' = 1.25$ , the following equation<sup>2</sup> gives pressure drop.

$$\Delta P_e' = \frac{1.83 (Z)^{0.2} N_r (G_s')^{1.8}}{10^6 (D_s')^{0.2} S.G.} \quad (4)$$

When  $P'/D_s' = 1.33$ , take 94.5% of pressure drop found by Eq. (4). To make Figs. 5 and 6, use Eq. (4).

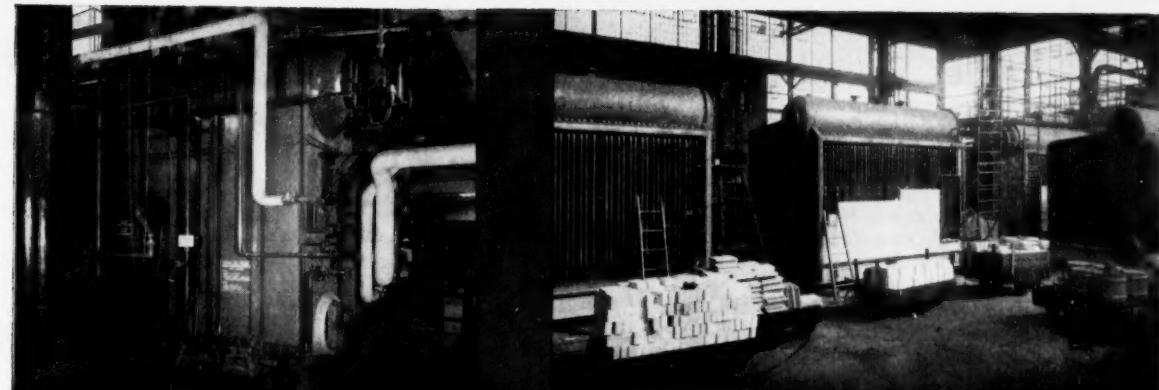
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1. Chen, N. H., *Chem. Eng.*, Oct. 20, 1958, p. 156.
2. Donohue, D. A., *Ind. Eng. Chem.*, 41, 2459-2511 (1949).
3. Katz, D. L. and R. B. Williams, *Pet. Refiner*, Mar. 1954, pp. 145-149.
4. Kern, D. Q., "Process Heat Transfer," p. 555, McGraw-Hill Book Co., Inc., New York (1950).
5. Newell, R. G., *Pet. Processing*, April 1957, p. 80.
6. "An Opportunity to Cut Costs and Increase Capacity With Wolverine Trufin," Wolverine Tube Div., Calumet & Hecla, Inc., Allen Park, Mich.

### Nomenclature

$C$  Specific heat at average temperature, Btu./(lb.) ( $^{\circ}\text{F}$ .).  
 $D_s$  Equivalent diameter of fin tube, ft.  
 $D_s'$  Equivalent diameter of fin tube, in.  
 $D_o$  Nominal diameter of tube, in.  
 $f$  Friction factor, dimensionless.  
 $G_b$  Mass velocity in baffle opening, lb./( $\text{hr.}$ ) (sq. ft.).  
 $G_s'$  Mass velocity in baffle opening, lb./( $\text{sec.}$ ) (sq. ft.).  
 $G_o$  Crossflow mass velocity, lb./( $\text{hr.}$ ) (sq. ft.).  
 $G_c'$  Crossflow mass velocity, lb./( $\text{sec.}$ ) (sq. ft.).  
 $G_e$  Geometric mean mass velocity, lb./( $\text{hr.}$ ) (sq. ft.).  
 $G_e'$  Geometric mean mass velocity, lb./( $\text{sec.}$ ) (sq. ft.).  
 $g$  Gravitational constant, 32.2 ft./sec.<sup>2</sup>  
 $h_f$  Heat transfer coefficient, Btu./( $\text{hr.}$ ) (sq. ft.) ( $^{\circ}\text{F}$ .).  
 $k$  Thermal conductivity of fluid at average temperature, Btu./( $\text{hr.}$ ) (sq. ft.) ( $^{\circ}\text{F}/\text{ft.}$ ).  
 $N_b$  Number of baffle openings.  
 $N_r$  Number of tube rows normal to flow.  
 $P'$  Tube pitch, in.  
 $S.G.$  Specific gravity of fluid.  
 $Z$  Viscosity of fluid at average temperature, centipoise.  
 $Z_w$  Viscosity of fluid at wall temperature, centipoise.  
 $\Delta P_c$  Crossflow pressure drop, lb./sq. ft.  
 $\Delta P_b'$  Crossflow pressure drop, psi.  
 $\Delta P_s'$  Pressure drop through baffle opening, psi.  
 $\Delta P_e'$  Shellside pressure drop, psi.  
 $\mu$  Viscosity of fluid at average temperature, lb./( $\text{hr.}\cdot\text{ft.}$ ).  
 $\mu_w$  Viscosity of fluid at wall temperature, lb./( $\text{hr.}\cdot\text{ft.}$ ).  
 $\rho$  Density of fluid at average temperature, lb./cu. ft.  
 $\phi_p$  Physical property factor,  $C^{0.333} k^{0.008} / Z^{0.297}$   
 $\phi_Z$  Viscosity correction factor,  $(Z/Z_w)^{-0.14}$

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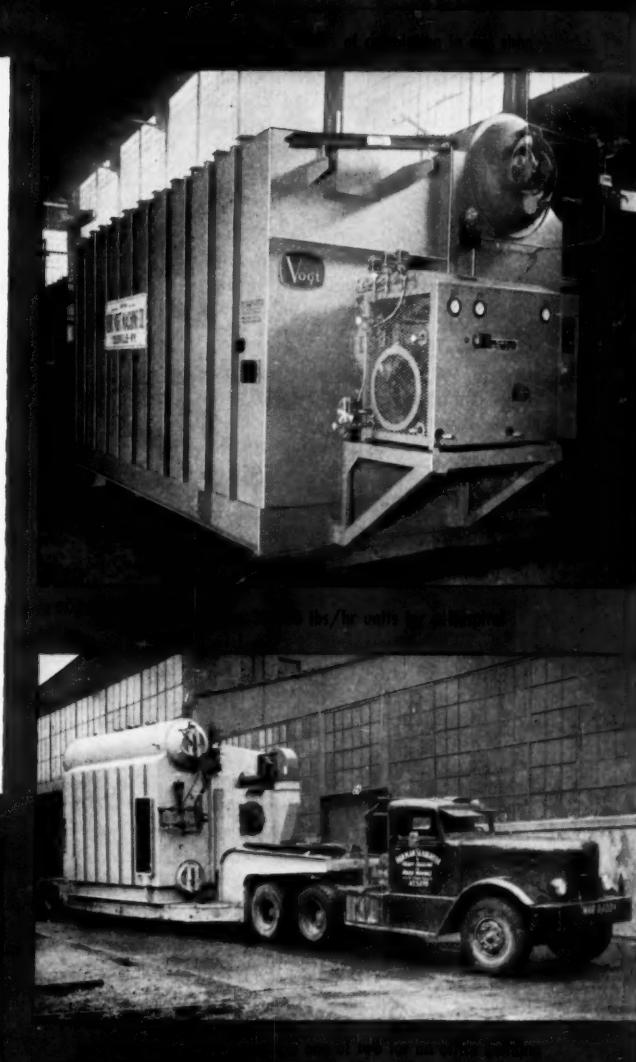


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## NO. 12: Piping and Equipment Insulation

Roy C. Kirchner, Western Asbestos Co., San Francisco, Calif.

## Tables Speed Insulating Estimates

Most insulation manufacturers use a standard price list for quoting price for equipment and piping insulation. A published price list is available in the trade from which manufacturers may conveniently discount at some percentage of the base list.\*

The tables we've presented here are parts of the base list. They may be used for high- and low-pressure insulation in the temperature range of 50 to 1,000 F. They will usually give a cost estimate a little on the high side because no discount is included.

You'll note in Table I that a factor is included for each pipe insulation thickness. This factor, in your computation, multiplies the list price in the table to account for labor and accessories. For block insulation of equipment (Table II), a factor of four is suggested. Should a great quantity of block insulation be involved, we advise a close look at this factor.

After the factored costs for pipe insulating are summed, you should increase the total by 10% to account for fittings. This average figure may vary as more or

\*The complete table, including all net prices from 0 to 99% discount, can be obtained from Asbestos, 807 Western Savings Fund Bldg., Philadelphia 7, Pa.

## Compare Tables I &amp; II With Close Method

To the right is a comparison of two estimates, one made by this approximate method and the other by our own company's closely estimated method. The hypothetical job that it represents includes a vessel, heat exchanger, and piping (including typical valves and fittings). The approximate method total differs from the close estimate total by 5.8%.

## Let's Have Your Cost File Ideas

The CE Cost File has received favorable comment from many readers. Praise flatters us, but we're more interested in providing for you a continuing cost data service. Dollar data for preliminary cost estimates is our aim. If you have

cost graphs, tables, data or correlations on equipment, design, construction, operation or other areas of interest to chemical engineers, send them, with a minimum of text, to CE Cost File Editor, Chemical Engineering, 330 West 42nd St., New

York 36, N. Y. Any legible form is acceptable. We will pay regular space rates for all published material.

Correction for CE Cost File—III, *Chem. Eng.*, Aug. 11, 1958, p. 151: Tube material factor for Type 304 SS at 4,000 sq. ft. should be 2.2.

## List Price of Pipe Insulation—Table I

(List price \$/lineal ft.)

Pipe Size ▼	Insulation Thickness	Std.	1 in.	1½ in.	2 in.	2½ in.	3 in.
	Factor†	× 4	× 3	× 2.5	× 2.5	× 3	
½ in.		0.22	0.46	0.75	1.00	1.20	
¾ in.		0.24	0.49	0.80	1.05	1.35	
1 in.		0.27	0.52	0.85	1.10	1.40	
1¼ in.		0.30	0.56	0.90	1.15	1.45	
1½ in.		0.33	0.60	0.95	1.20	1.55	
2 in.		0.36	0.64	1.00	1.25	1.65	
2½ in.		0.40	0.70	1.05	1.35	1.75	
3 in.		0.45	0.76	1.15	1.50	1.90	
4 in.		0.60	0.88	1.35	1.80	2.20	
6 in.		0.80	1.10	1.70	2.25	2.70	
8 in.		1.10	1.35	2.00	2.55	3.15	
10 in.		1.30	1.65	2.40	3.05	3.65	
12 in.		1.85	1.85	2.70	3.40	4.10	

†Multiplies list price to account for labor and accessories.

## List Price of Block Insulation—Table II

Thickness \$/Sq. Ft.

1 in.	0.30
1½ in.	0.45
2 in.	0.60
2½ in.	0.75
3 in.	0.90

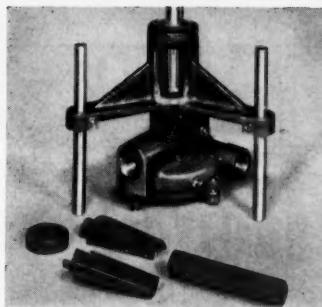
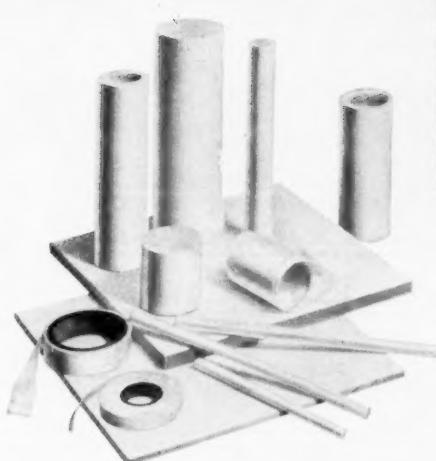
less straight pipe is used in comparison with the number of fittings.

Although the preceding calcu-

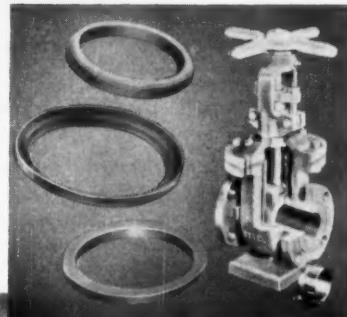
lation is fairly accurate for estimates in the range of \$500 to \$1,000, you should modify estimates outside this range as follows:

Less than \$250—	increase total by 25%
\$250 to \$500—	increase total by 10%
\$1,000 to \$5,000—	decrease total by 10%
Over \$5,000—	decrease total by 20%

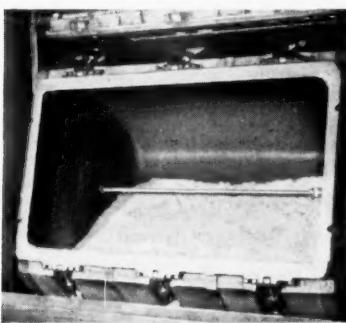
Insulation	Approximate Method	Close Method
120 ft., 4" pipe, 2" insul.	120 × \$1.35 × 2.5 = \$382.08	\$382.08
22 ft., 2" pipe, 1½" insul.	22 × \$0.64 × 3 = 42.24	65.98
12 ft., 1" pipe, 1½" insul.	12 × \$0.52 × 3 = 18.72	23.10
18 ft., 3" pipe, 1" insul.	18 × \$0.45 × 4 = 32.40	44.40
6 ft., 1" pipe, 1" insul.	6 × \$0.27 × 4 = 6.48	10.59
129 ft., 1½" pipe, 1" insul.	129 × \$0.33 × 4 = 170.28	178.20
	<b>652.20</b>	<b>704.35</b>
81 sq. ft., 2" block	10% for fittings = 65.22	65.22
	81 × \$0.60 × 4 = 194.40	166.86
	<b>Total</b>	<b>\$921.82</b>
		<b>\$871.21</b>



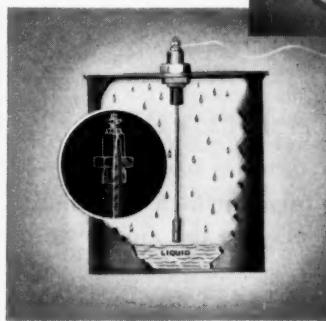
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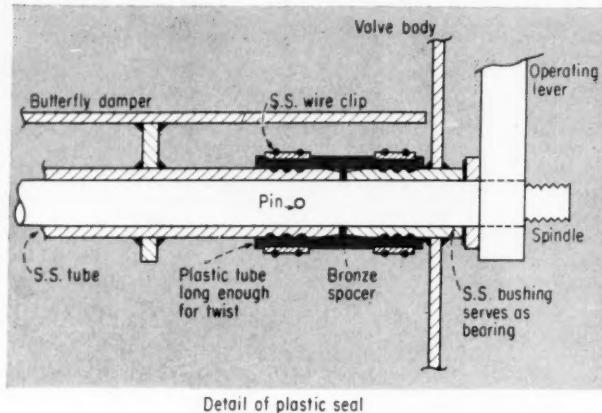
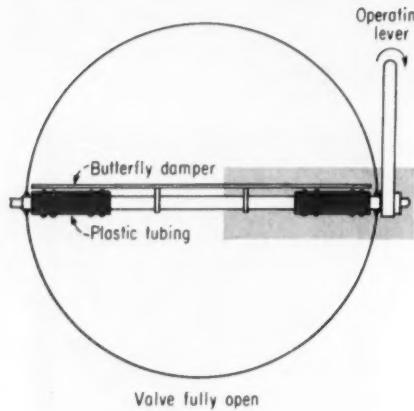
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PRACTICE . . .

## PROCESS DESIGN NOTEBOOK

EDITED BY T. R. OLIVE



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The butterfly itself is attached to a stainless tube pinned to the

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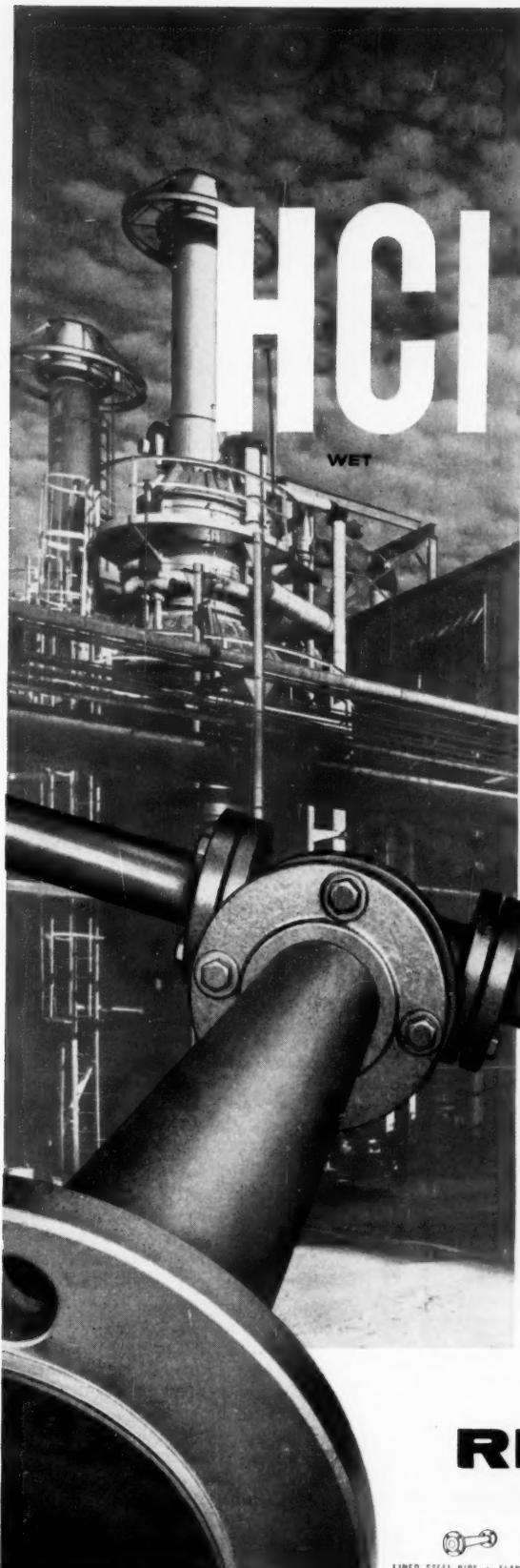
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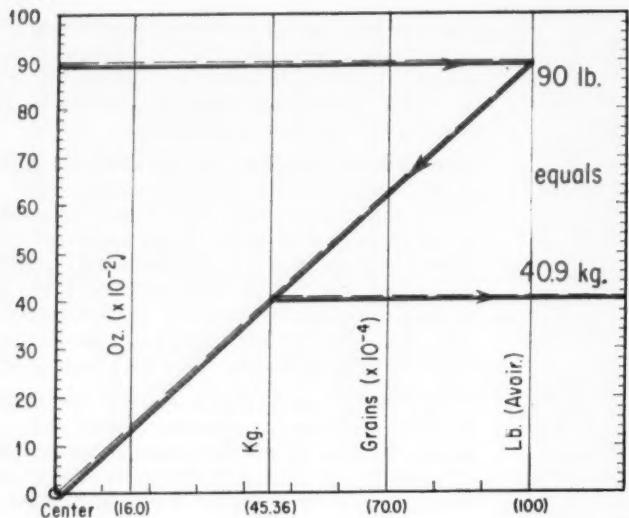
# Four Handy Conversion Charts

Jerome A. Seiner

Development Engineer, Pittsburgh Plate Glass Co., Springdale, Pa.

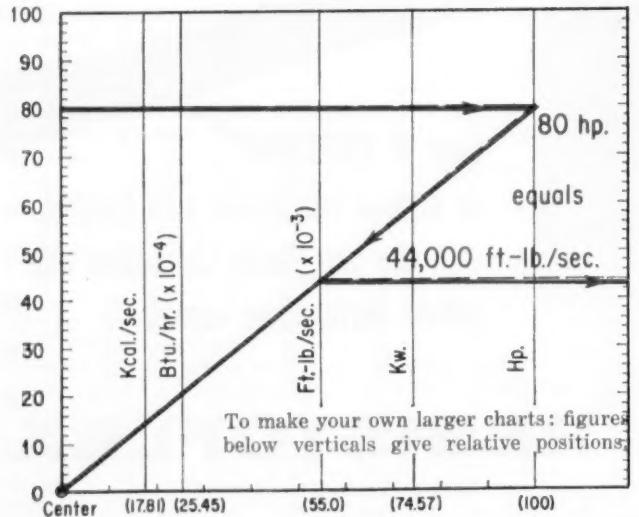
Like the author's earlier charts (May 5, 1958: Pressure; and Oct. 20, 1958: Flow) the conversion charts below are used by drawing a line from the "center" to the ordinate of the quantity to be converted and reading the intersections of this line with the verticals drawn for the other desired units. For example,  $80 \text{ hp.} = 44 \times 10^6 = 44,000 \text{ ft.-lb./sec.}$

## Weight



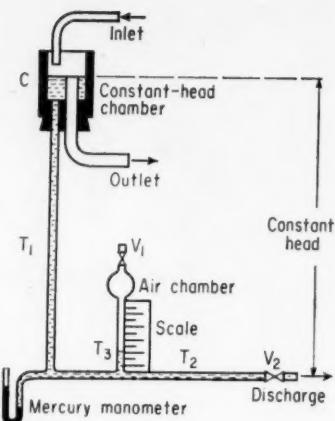
100  
90  
80  
70  
60  
50  
40  
30  
20  
10  
0

## Power



100  
90  
80  
70  
60  
50  
40  
30  
20  
10  
0

Conversion charts continued on p. 152



## System for Controlling Small Flows of Liquids

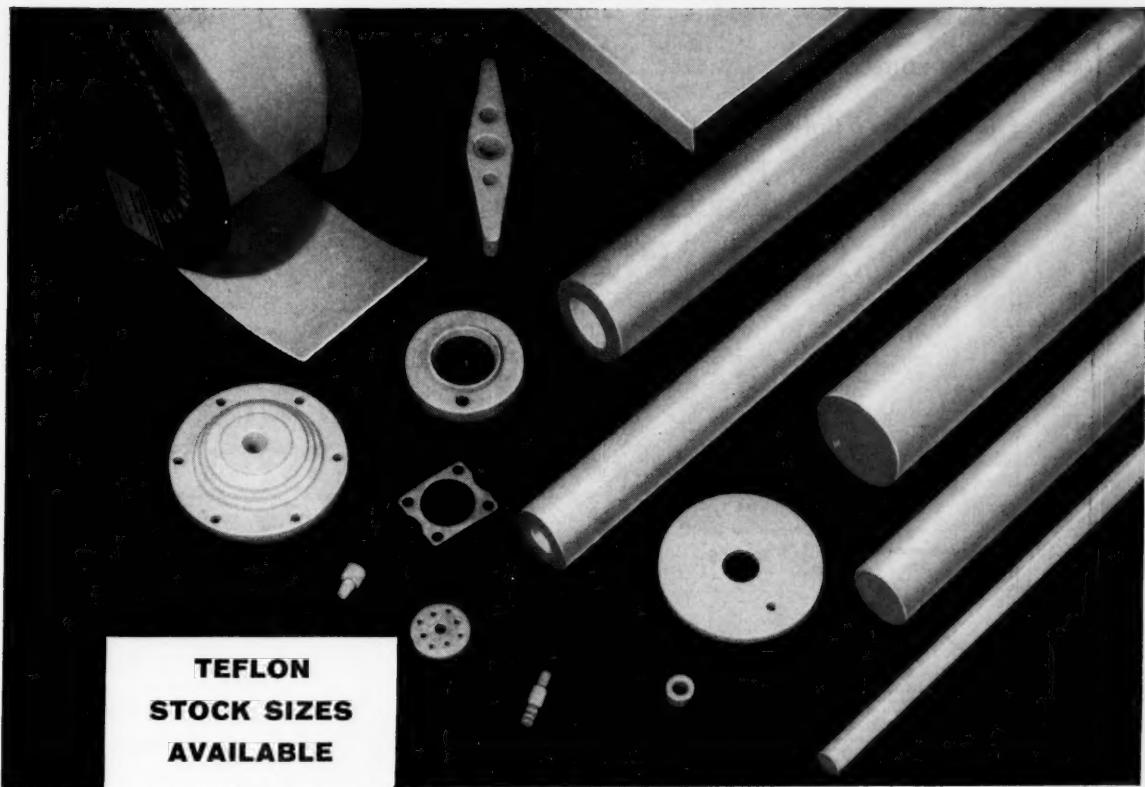
Roberto Alvarez R.

Professor of Chemistry  
Technical University of Valparaiso  
Valparaiso, Chile, S. A.

Shown above is a simple apparatus, made entirely of laboratory glassware, which can be used successfully in the accurate manual control of small liquid flows in pilot installations. The device employs no orifice but measures the pressure gradient during flow at a point a short distance above the discharge.

A constant-head chamber receives a flow of the liquid to be metered, in excess of the desired metered flow rate. An overflow assures a constant head. Branch  $T_3$  in the tubing system is terminated by a small air chamber and air-tight valve  $V_1$ . When regulating valve  $V_2$  is closed and there is no flow through the system, liquid is forced into  $T_3$ , compressing the air. By adding a little air through  $V_1$ , or releasing a little, the zero of the air manometer can be adjusted to any desired point on the scale. Such adjustments will be needed from time to time as the room temperature changes.

To calibrate the system, first make sure that no air bubbles are being trapped in chamber C and forced down tube  $T_1$ ; if they are, this air will find its way into  $T_3$  and the air chamber, upsetting the calibration. Then, using a graduate and stopwatch, find the meniscus level in  $T_3$  at various flow rates as  $V_2$  is gradually



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Diameter:  $\frac{1}{16}$ " to  $7\frac{1}{4}$ "  
in various lengths

**TUBING (rigid)**

O.D.  $\frac{1}{16}$ " to 12"  
I.D.  $\frac{1}{4}$ " to  $6\frac{1}{8}$ "  
depending on O.D.

**Sheet**

Thickness:  $\frac{1}{16}$ " to 2"  
Sizes: 12" x 12", 24" x 24",  
and 48" x 48"

**TAPE**

Thickness: .001" to .125"  
Widths:  $\frac{1}{4}$ " to 18"  
Ten fade-proof colors

**SPAGHETTI TUBING**

AWG sizes 30 to 0.  
Thin and regular wall thickness  
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**THIN WALL TUBING**

I.D.  $\frac{1}{16}$ " to 1"  
Wall thickness: .030" to .050"

**ROUND AND SQUARE BEADING**

Round: Diam. .030" to .150"  
Square: .020" to .156"  
across the sides

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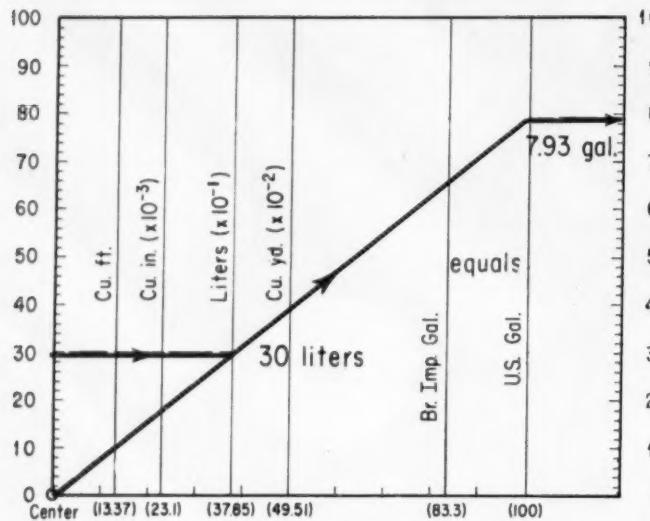
**The Polymer Corporation of Penna. • Reading, Pa.**

Export: Polypenco, Inc., Reading, Pa., U.S.A.

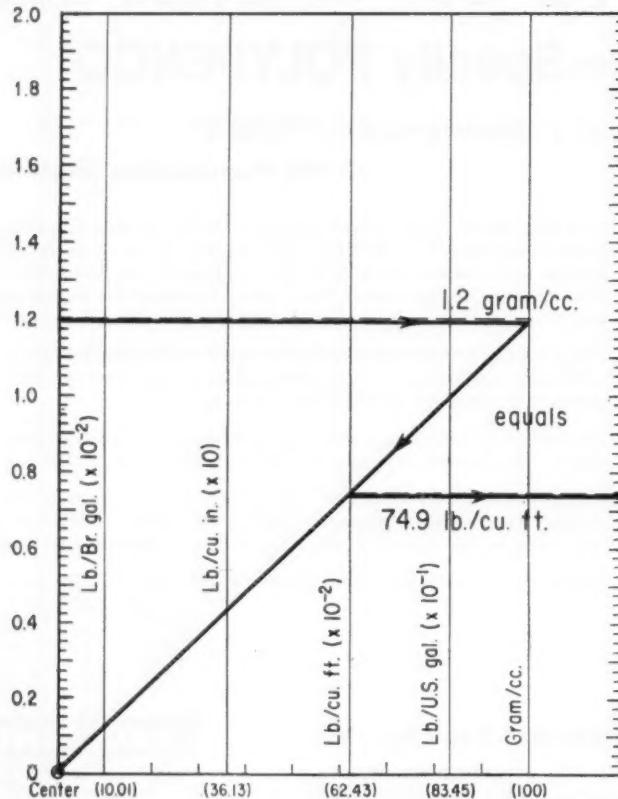
\*DuPont Trademark for fluorocarbon resins

## Conversion Charts (Cont.)

## Volume



## Density



(Continued from p. 150)

opened. The air manometer calibration curve will be slightly convex downward from zero to the maximum flow rate.

The characteristics of the meter depend on the flow resistance of the various branches of tubing so if these are changed a new calibration will be needed. Since pressure drop will vary with the viscosity and density, both of which are affected by temperature, effort should be made to hold the liquid temperature fairly constant, while a new calibration will be needed if a different liquid is to be metered. Practical measurements are 75 cc. for the air chamber, a total head of about 100 cm., and inside tubing diameter of 0.9 cm.

## Formulas for Formed Head Characteristics

P. V. Folchi

Consulting Engineer  
Cincinnati, Ohio.

Ordinarily, in figuring volume, surface area and over-all length of cylindrical tanks, the engineer will make use of a book on tank heads such as one of those put out by the head manufacturers. However, if such a book is not at hand the following formulas will permit the principal characteristics of the three main kinds of heads to be calculated with an accuracy within 5%.

In the formulas:  $A$  is surface area of the head;  $ID$  is inside head diameter;  $IDD$  is inside depth of dish;  $OD$  is outside head diameter;  $V$  is volume of the head;  $w$  is weight per unit area of head metal (lb./sq. ft. if dimensions are in ft.); and  $W$  is weight of the head. These formulas do not include the straight flange which should be figured as part of the cylindrical shell.

Std. Flanged, Dished Head:

$$IDD = OD/7 \quad W = Aw$$

$$A = 1.05(OD)^2 \quad V = 0.43(OD)^3$$

ASME Flanged, Dished Head:

$$IDD = OD/6 \quad W = Aw$$

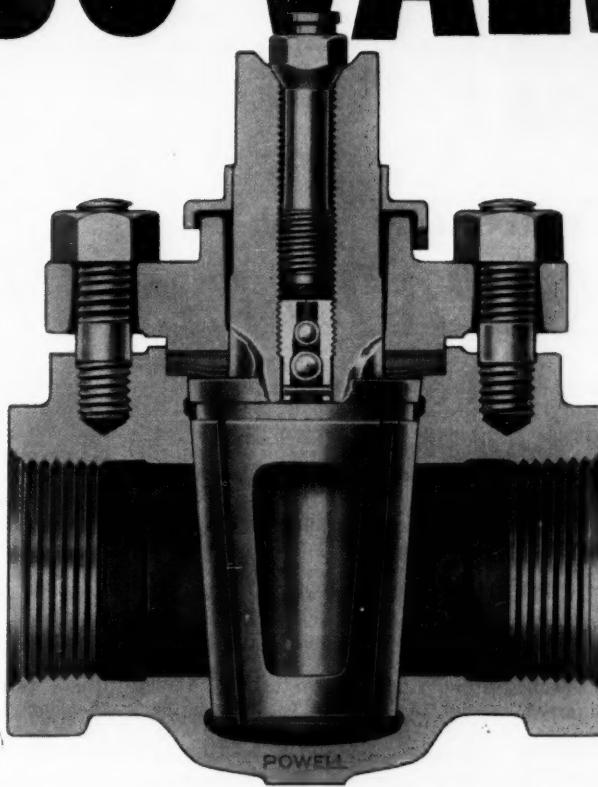
$$A = 1.08(OD)^2 \quad V = 0.59(OD)^3$$

Ellipsoidal Head:

$$IDD = ID/4 \quad W = Aw$$

$$A = 1.23(ID)^2 \quad V = (ID)^3$$

# POWELL LUBRICATED PLUG VALVES



Sectional-Powell Lubricated Plug Valves, Single Gland type. Also available with Flanged Ends.

Powell Lubricated Plug Valves have many advantages over conventional types of Valves:

- Simple design: only 3 basic parts—body, bonnet, plug.
- Quick, complete shut-off.
- Tapered Plug assures positive seating.
- Machined surfaces of plug and body are not exposed in open position.
- Cavity-free straight passage assures streamlined flow.

Available in sizes  $\frac{1}{2}$ ", through 16", depending on the type required—semi-steel 175 and 200 pounds WOG; carbon-steel ASA 150 and 300 pounds. Also in other alloys on special order.

For complete information, write for our new Lubricated Plug Valve Catalog, Number PV-5. Or contact your local Powell Distributor.

**The Wm. Powell Company • Cincinnati 22, Ohio**  
Dependable Valves Since 1846

**POWELL... world's largest family of valves**

PRACTICE ...

## YOU & YOUR JOB

EDITED BY R. F. FREMED



**William Ralph Collings,**  
chemical engineer and president of  
Dow Corning Corp., gives you his ideas on  
how to develop yourself professionally.  
He charges that, today, . . .

# The Thing You Lack Most Is... *IMPATIENCE*

During the past 15 years I have been concerned with the development of new processes and products in a new industry. Thus, from necessity, I have been equally concerned with the development of new men.

For since Dow Corning Corp. was created in 1943, a substantial part of our progress has been in the hands of young men. Watching them grow into greater responsibilities and helping them when they needed help has been an absorbing part of my job.

Sometimes chemical processes and products are a lot easier to develop and control than chemical engineers are. But there are similarities. One of our best chemical inventors stresses repeatedly the fact that while various silicone processes have similarities, each is unique. The same can be said of chemical engineers.

Each of you has your own ideas about your ability, your objectives, your ideals, your future. Probably more often than not, these ideas are hazy. You cannot see—and usually no one else can see—exactly where you

are bound in the complex growing fields in which you are expected to function. But this much is certain: You are an individual and must be treated as such.

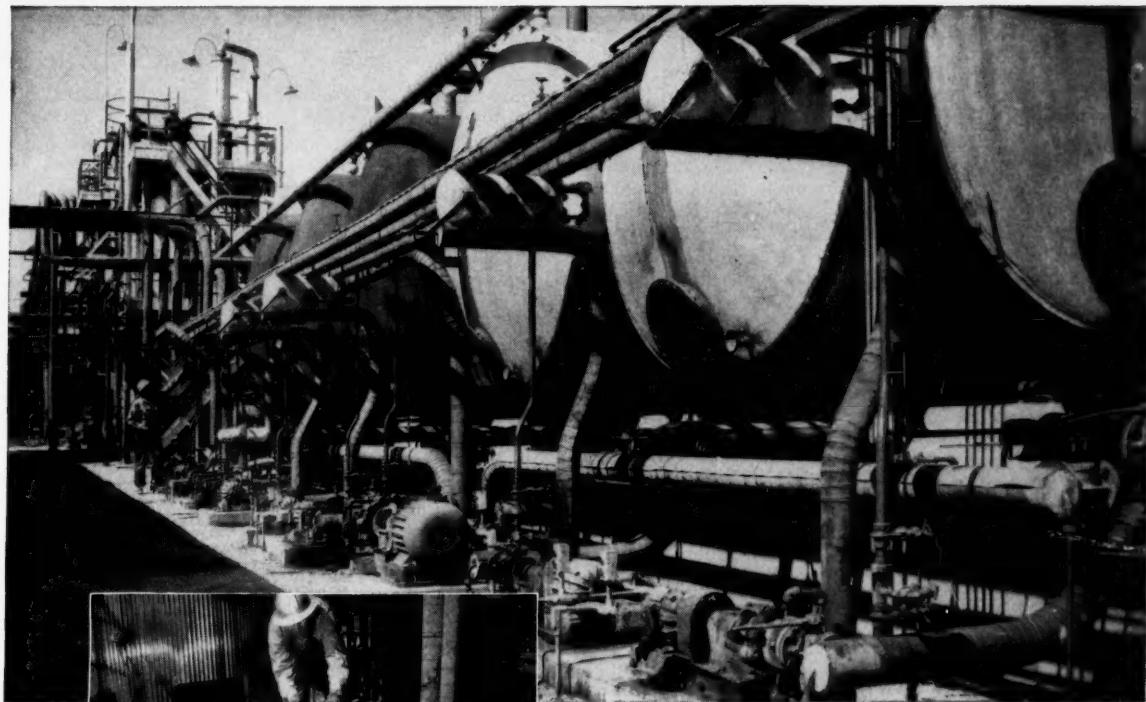
Because our field is so variable and the jobs in it so diverse, we do not make jobs to fit people. All that we can do is pick out a project for which a man seems to be equipped and see how he does. If he is flexible and adaptable, he usually finds his way around. In doing so he gets experience in working with people and equipment, and almost always, the experience makes him better able to do the next job that comes his way. Each job is the center of a complex of company needs and fellow workers' personalities that can never be duplicated exactly.

I count heavily on the interplay of individuals—the things they learn from each other—to provide powerful influences toward shaping the future of our young men. The development of a chemical engineer cannot be engineered. It must be a flexible, adaptive process, like any other creative act.

Development is a two-phase affair. Each of us strives to develop himself. Each of us has his development shaped by outside forces—some accidental, some deliberate. But experience can, to some extent, be controlled. The chemical engineer can use experience for his own development, and management can use it to aid in the development of chemical engineers.

Looking back over my own life, I recall many experiences that have contributed to my own growth. People, of course, are experiences. There was Mr. Hoornstra, my German teacher at East Technical H. S. in Cleveland. Then there was Mr. Atwater, my mechanical drawing teacher. Next came a graduate of the Case School of Applied Science, Class of 1906. He was a "chemist"—they didn't recognize them as chemical engineers then—and he encouraged me and helped me to turn the dream of further education into reality.

I stayed out of Case the first semester of my sophomore year. When I asked Doc Veazey, then professor of analytical chem-



## **La Bour Pumps Make Good on Another Kind of Tough Job**

Most of the tasks assigned to La Bour Pumps involve corrosive liquids, suction conditions aggravated by vapors or gases, or solid particles such as crystals or dirt. Sometimes all three appear in one application. But here's a job with none of these problems, yet it took the unique design and capabilities of La Bour to provide a satisfactory solution.

There are 32 La Bour Type DZT

pumps now at work at Bareco Wax Company, Barnsdall, Okla., and 12 others are in process of installation there. They move wax, at temperatures above 200° F., through all stages of manufacture. Pumps and lines are steam-jacketed throughout.

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ORIGINAL MANUFACTURERS OF THE SELF PRIMING CENTRIFUGAL PUMP

# **LABOUR**

THE La BOUR COMPANY, INC. • ELKHART, INDIANA, U.S.A.

CHEMICAL ENGINEERING—April 6, 1959



stry (later chairman of the Dow Research Committee), what I was to do about his quantitative analysis course, he said: "Get the lecture notes from one of your classmates, and I'll give you the tests from time to time. You can do the lab work by following the lab manual."

This astonished and pleased me. How easy that made the task of fitting the study and lab work into my mixed schedule. And his willingness to adjust his system of instruction to the human need made me everlastingly grateful to Doc Veazey.

I am impressed by how much my career has been shaped by the helpful kindness of many of the older men who gave me a hand along the way; and who, in fact, knew much better than I did what I could do. They had a profound confidence in young men. They gave them jobs to do, and in spite of our relative technical ignorance compared with today's chemical engineers, we managed to get most of the jobs done.

In industry we have much to learn about the continuing development of technical people. Probably no way will ever be better than giving a man a job to do and seeing how he does it. But how much help does he need?

At Dow Corning we have a few devices that we think contribute to individual development. I'll say a word about three.

First, the man in the organization who is most directly responsible for the development of the individual is his supervisor. Therefore we have a voluntary, self-planned and self-managed discussion program for all supervisors. Then we have an employee counseling program that requires each supervisor to review in thoughtful, scheduled conferences the development of each of his salaried people at least once a year.

These conferences are so designed that the individual is encouraged to talk about himself, his job, his problems, his aspirations. The advantage of this approach is that each man has a real opportunity to find out from his immediate supervisor ex-

actly where he stands and to speak up about any subject that concerns him—and particularly about what he would like to have happen to him.

Next, we have found the use of advisory study groups made up of chemical engineers and other professional men helpful in the study of specific problems in depth. Both problems and membership in the groups cut across departmental lines. In this way we give our chemical engineers and other professional men a good look at management problems.

Most of the recommendations that come out of these groups have been accepted and acted upon. Frequently the recommendations are carried out—in part, at least—by those who made them. We think this cooperative work between men from different departments leads to better understanding of the functions, problems and outlook of men throughout the company and fosters management capabilities.

In a third, more specialized way we try to aid in the development of our technical people. We set aside one week a month for progress reports on our research and development projects. These meetings are held in my office. The men actually doing the work on the projects usually give the reports.

Though the primary purpose of these meetings is to communicate important information directly from its source to top management people and to allow for suggestions from them, this face-to-face presentation of a man's work provides a powerful stimulus to the development of our chemical engineers.

Perhaps the informal aspects of professional development are more demanding, require more imagination and are more important than the formal ones. By definition, they do not fall into any program. They require management to be ever attentive to the personal element, to remember the fellow out in the farthest plant and the men on the most distant sales frontiers as well as those who pass under notice daily.

What a chemical engineer can

do about his own development seems to me an individual matter, and I hesitate to write a prescription. I will say that technical societies offer him many more opportunities for professional activities than were available in my youth.

If I were asked to name one quality that I find lacking—one quality that seemed to be more dominant years ago than it is today—I would say, "Today we lack IMPATIENCE."

Today, the complexity of our industrial and technical organizations sometimes becomes a barrier to progress. There are obstructions to accomplishments on all sides. Someone always has to wait for someone else to get things done. Shop people, union regulations, analytical results, delays in getting reports typed, almost any one of a hundred or more routine matters can obstruct completion of essential work.

Yet somehow they must be overcome. In my opinion, what we need to instill in more of our young people today is impatience to get on with the job. Impatience to know. That's what it takes to stimulate the search for truth.

One final word. I would stress the idea that self-development cannot be undertaken for dead-sure ends. It must be carried on for its own sake. Whether on the job or off, reaching for worthwhile experiences and extracting from them the maximum of growth must be done because it is good in itself. Just as there are growth companies, there are growth personalities. In addition to doing what it can to multiply the opportunities for varieties of experience for all professional people, management must be sharply observant of the growing that is going on.

But this awareness carries with it no promise of special reward beyond that for merit that exists in all American enterprise. Matching a man and a job has a high degree of the fortuitous about it. The big thing is for each of us to be ready, within the scope of our natural capacities and interests, for whatever happens to come along.



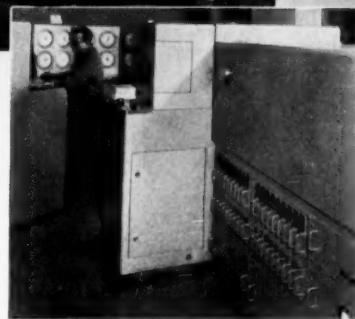
General view of the wet laboratory

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Resistant Castings**

**One phase of Value Analysis is group skill in determining how a presently satisfactory component can be made better with a saving in cost.**

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Physical testing machine



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*"developing your castings from  
the blue print to the  
finished component."*

WAUKESHA FOUNDRY COMPANY  
Waukesha, Wisconsin

Gentlemen:

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 I would like to have your field technician call.

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TITLE \_\_\_\_\_

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PRACTICE . . .

## OPERATION & MAINTENANCE EDITED BY M. D. ROBBINS

Months Ahead . . . . . Detailed Preplanning

Check records  
List repairs

Weeks Ahead . . . . . Intensive Planning

Prepare work orders  
Inspect proposed work  
Determine scope of work  
Order materials and replacement parts  
Determine manpower requirements  
Prepare work schedules

Shutdown Day . . . . . Actual Work Begins

### Then: Intensive Planning

About six to eight weeks before shutdown, production supervision initiates the necessary work orders for work to be performed by maintenance.

Maintenance then determines the scope of each work order through personal inspection and discussion with the production people. Necessary materials and replacements are placed on order and stock items are checked for availability.

At this point, exact manpower requirements by craft, manhours and shifts to be worked are established.

Then, a detailed work schedule is prepared listing each job separately and showing the number of people in each craft required each day. Production usually schedules an eight-to-ten day shutdown. This is based on inventory sales requirements and work to be done.

Detailed shutdown and decontamination procedures are initiated. Based on past experience, actual times are determined when specific pieces of equipment will be available for maintenance. This way, the maintenance group schedules its work force load and crafts properly.

Pipe renewals and temporary piping requirements are fabricated ahead of time. About one week prior to shutdown, necessary materials, piping, renewal catalyst and spare equipment are brought to the unit, ready for use.

Necessary scaffolds and temporary lighting facilities are set up and hoisting and rigging equipment installed. If necessary, a motor crane is brought to the unit and the required boom length installed a day or two in advance.

## Turnaround Maintenance

**DANA CASH, Maintenance Supv., Westvaco Chlor-Alkali Div., Charleston, W. Va.**

USING molten sulfur and methane gas as raw materials, our modern petrochemical plant in South Charleston, W. Va., is a highly automated process producing large quantities of carbon bisulfide.

Chemical operation here is continuous, and success is measured in terms of economics. Very simply, profits are made when the plant is operating and only expenses are incurred when the unit is down.

To maintain continuous operations during the months between planned shutdowns, production and maintenance supervision apply some of the petroleum industry's concepts of periodic turnaround.

### How We Schedule Downtime

Supervision schedules one annual and one semiannual shutdown.

Main purpose of the annual shutdown is for a mandatory state inspection of steam generating boilers in the process. Main purpose of the semiannual outage is to prepare the cooling equipment for summer operation—brush-cleaning the tubes and acid-cleaning the water side of heat exchangers.

Close check is continuously kept on the condition of each item of equipment in the unit. This is so all needed repairs, replacements, preventive maintenance work, equipment inspections and engineering design changes can be made during these two scheduled outages.

Annual boiler inspection is scheduled for early fall, while the semi-annual outage is in early spring. This way, both downtimes come during periods of pleasant weather and we get maximum labor productivity out of the men.

### Detailed Preplanning Necessary

For months before the actual shutdown, a cumulative list of necessary repairs is kept by maintenance and production supervision. In the meantime, maintenance supervision determines and lists—based on past experience—necessary preventive maintenance work.

Repairs are pinpointed by visual observation during operation, periodic review of preventive maintenance reports, equipment repair records and abnormal pressures and temperatures.

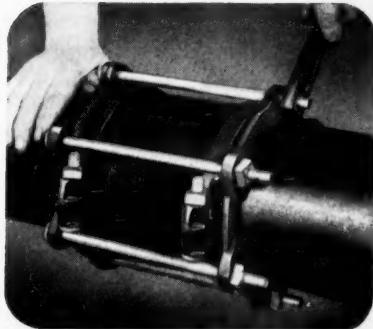
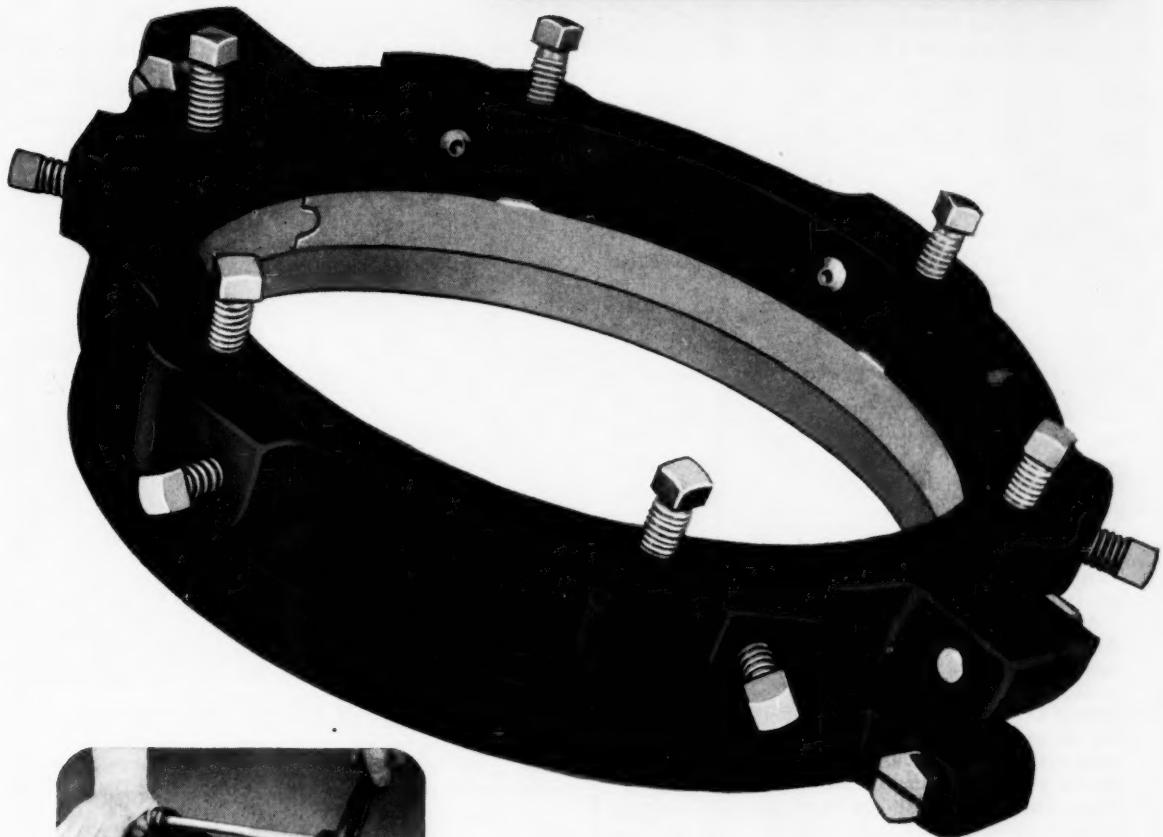
### Now for the Actual Work

At the start of shutdown, maintenance crews are on standby duty to provide necessary decontamination help: inserting slip blinds, installing temporary purge and steam-out connections, etc.

On completing decontamination of a piece of equipment, maintenance checks with supervision before opening up the equipment.

From past experience, certain

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AT FITTINGS



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**SKINNER-SEAL** COLLAR LEAK CLAMP, with its sealed gasket and massive construction, stops every type of collar leak.

**SKINNER-SEAL PIPE JOINT CLAMP** for pipe repair permanence. Stops leaks at joints where pipe is screwed into a fitting. Any temperature—pressures up to 2,000 pounds. It saves the cost of tearing out and renewing leaky fittings. Prevents shutdowns. This clamp, constantly improved over the years, has been serving the industry for over half a century. In stock at all supply stores!

M. B. SKINNER COMPANY, SOUTH BEND 21, IND., U. S. A.

PIPE JOINT CLAMP  
COLLAR LEAK CLAMP

**SKINNER-SEAL**

pieces of equipment must be cleaned or inspected thoroughly to determine the corrosion rate and replacement need. Equipment that remains clean and has a negligible corrosion rate is inspected less frequently.

Equipment inspection is by maintenance engineers. Detailed inspection reports are issued. These indicate observations, results and any need for duplicate replacement or incorporating better materials of construction on the next turnaround.

If the condition of the equipment is doubtful, thickness drillings are made and the vessel subjected to hydrostatic testing. On equipment on which it's difficult to measure corrosion rates, sonic measurements are taken.

Certain work requires specialists that aren't normally available in the maintenance forces. These people are brought in from the outside to do work such as stack relining, stack painting, etc.

As unforeseen and lengthy repairs arise, the work force load is increased or crews are shifted from less important work.

About two to three days before the startup deadline, another close look is taken at the scope of work remaining. Maintenance crews are shifted to the more critical remaining areas needed repairs. This is done so that key sections of the unit can be placed on standby ahead of time. Thus, the remaining work is done on less vital equipment that's easier to place on standby.

#### We've Got Results

- Planned shutdowns minimize unscheduled and emergency shutdowns. What this really means is greater on-stream time. In our case, on-stream time runs around 90%.

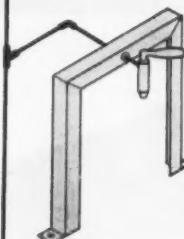
- We've found that planning provides a better opportunity to study the problems and determine improvements to make on the next planned shutdown. Result: Better quality repairs.

- In our case, the turnaround concept prepares the unit for maximum summer production when the temperature of the cooling water is high.

- We keep outage time to a minimum by preplanning and scheduling.

- Maintenance requirements between turnarounds are low.

## New Way to Move Lube Oils



C. JACKSON, Maint. Coordinator, Monsanto Chem. Co., Texas City, Tex.

Most multilevel plants face the problem of moving lubricating oils and fluids to the different floors. This can be a pretty costly problem—especially if you have several pieces of equipment needing different lubricants.

One inexpensive way to move these lubricants is shown in the accompanying sketch. This unit only requires a simple valve control at the level you're moving the oil to, and a minimum of material.

An air-operated drum-pump is used and it's extremely dependable. Since the discharge pressure of the pump equals the supply air pressure, the pump starts automatically whenever a valve in the oil discharge line is opened. You can regulate the air pressure if you want a lower oil discharge pressure.

For a fluid spigot, a lapped, tapered, plug-and-seat valve is used. This has the seat located at the outlet end of the valve body to minimize oil dripping after flow is stopped. There's a good tight seat for the tapered plug stem because of the oil pressure behind it.

Flexible oil and air hoses permit easy removal of the drum-

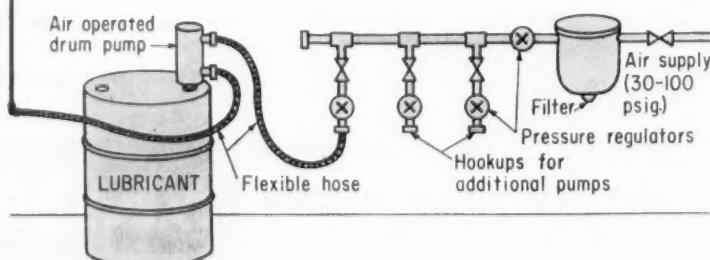
Here's a way to move lube oils in a multilevel plant with a minimum of cost. All you need is an air-operated drum-pump, piping and a spigot.

pump so you can insert it into a new oil drum.

Use a drum-pump that will pump at 15-20 gpm. and empty the drum to less than  $\frac{1}{2}$  in. from the bottom. Make sure your pump fits a standard drum bung connection and doesn't pressurize the drum. By using aluminum as a material of construction you'll avoid contamination.

#### Look to the Advantages

- Drums are located at ground level, wasting less area and making handling easier.
- Single valve operation controls the system.
- Air and oil piping requirements are at a minimum.
- There's air pressure on the pump packing at all times. This minimizes maintenance on the plunger cups.
- Installation will run you about \$150/pump plus labor.
- You can add multiple branches off the same pump at different levels.
- You can use this pump in hazardous locations that require explosion-proof equipment.
- Expensive costs involved in tank-pump set-ups or drum handling labor are eliminated.



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Newest  
**ATOMIC  
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VESSELS**

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**140,000# PRESSURE VESSEL FOR  
NUCLEAR AIRCRAFT RESEARCH**

This 70-ton vessel was fabricated by the Struthers Wells Corporation for the Plum Brook Research Station of the National Advisory Committee for Aeronautics. It measures 9' x 35' and has a total of 68 openings of various kinds, all precisely located to tolerances of watchmaker precision. Made of stainless clad carbon steel, it has a mirror-finished interior and required extremely careful and time-consuming fabrication. When your big and complex fabrication requirements call for the best in experience and facilities, look to STRUTHERS WELLS.

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**PROCESSING EQUIPMENT DIVISION**

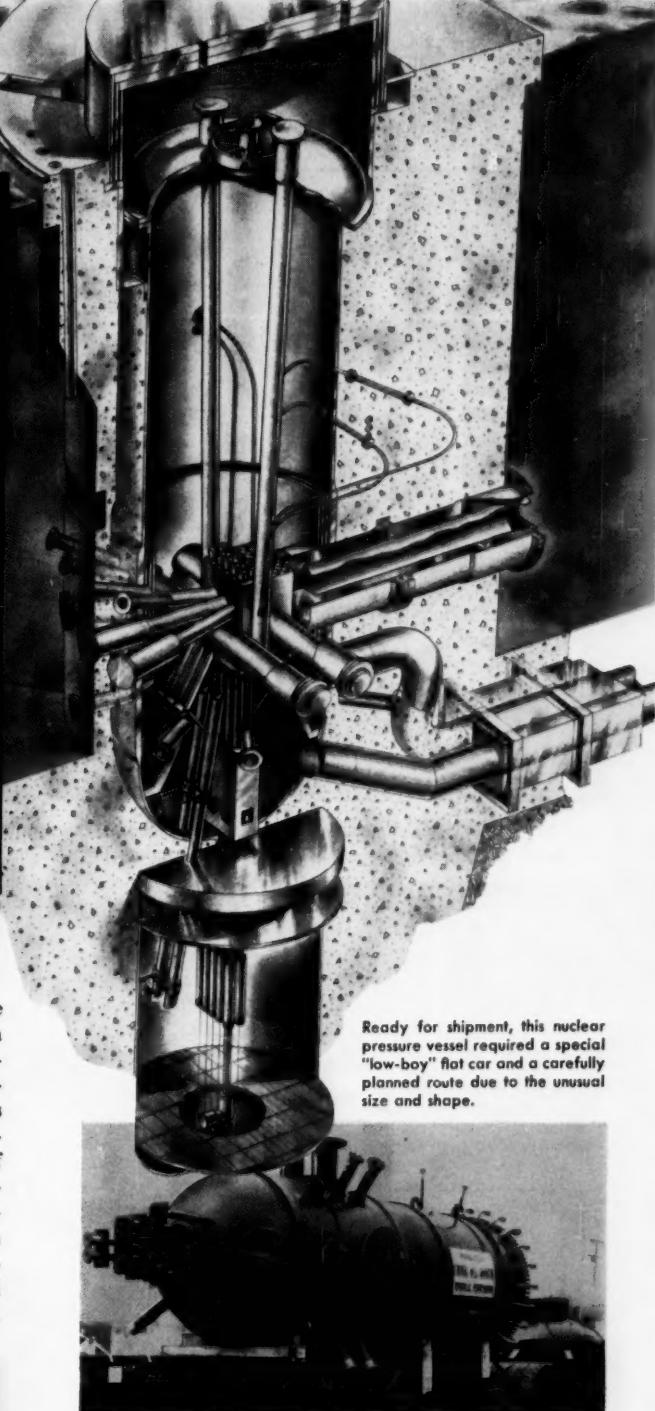
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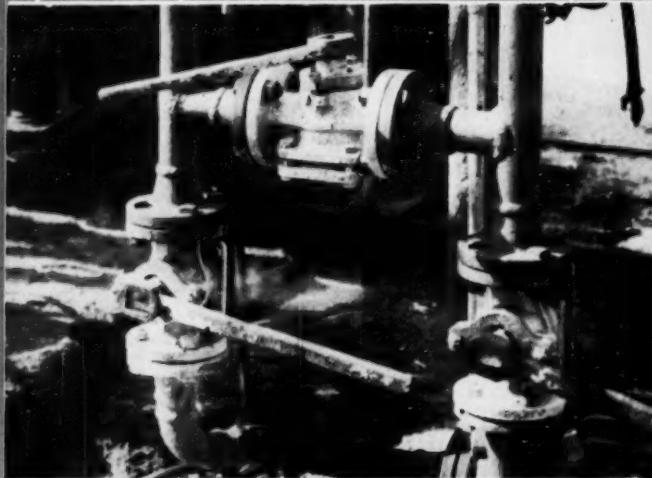
**Struthers  
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PRACTICE...

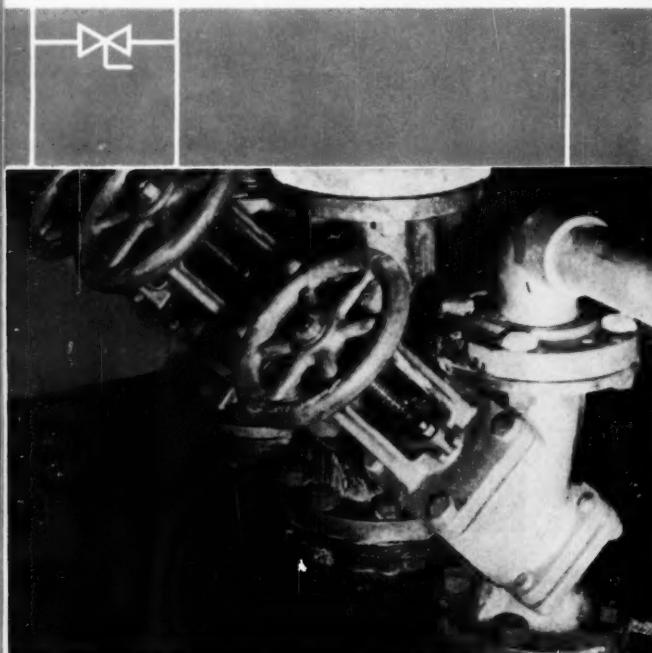
## CORROSION FORUM

EDITED BY R. B. NORDEN

### For Corrosives: Out-of-the-Ordinary Valves



**PLUG VALVE** (nonlubricated) has advantages over gate valves in corrosive service: low leakage and erosion, little holdup.



**Y-VALVE** has features of a good gate and a good globe valve: excellent throttling; low turbulence, erosion and wear.

Gate and globe valves have their place. But get to know more about Y and nonlubricated plug valves for erosive-corrosives.

R. B. Wooster, The Duriron Co., Inc., Dayton, Ohio

Today, when the average design engineer gets to that point in a project where valve types are to be put down on a piping flowsheet, he habitually specifies a gate valve for eight or nine services out of ten and a globe valve\* for the balance of the manually operated valves.

Within the last few years valve manufacturers have taken advantage of the exceptional properties of Teflon as a construction material for key valve components. As a result, where alloy valves are needed in chemical plant process work, there are coming into use two not-so-well-known valves: (a) the nonlubricated plug valve for open and shut or gate services; (b) the Y-type valve for manual throttling or globe services. These valves are not new. But many engineers are still unaware of their advantages for general use in process plants.

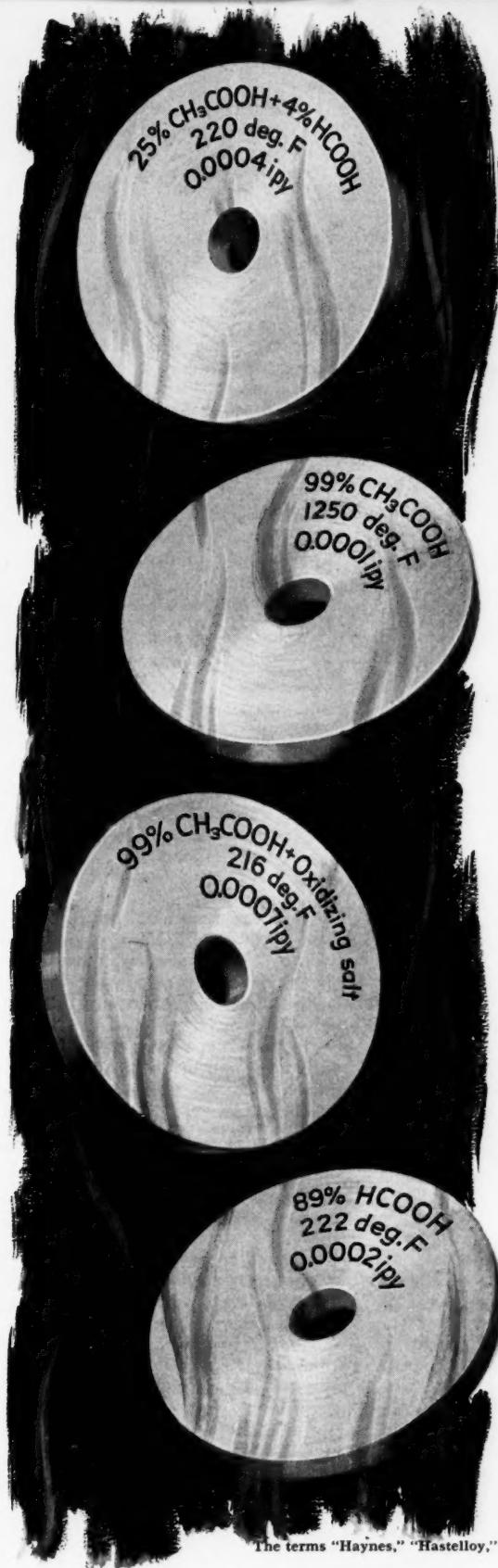
► **Many Advantages**—Nonlubricated plug valves offer benefits in on-off corrosive service of low leakage, little erosion, tight shut-off, no pockets and holdup, low maintenance. Y valves have good throttling characteristics and low erosion with no galling, compared to globe valves.

Let's take a detailed look at what these valves have to offer.

#### Plug Valves: for On-Off Service

A gate valve is normally used either wide-open or closed. Throttling is out of the question because of poor control and the

\* Not included in this discussion are special valves for unique service; or checks, relief valves, control valves, etc.



## Organic Acids Causing Corrosion?

...Test **HAYNES** Alloys

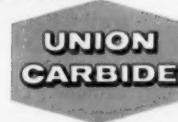
HASTELLOY alloy C and nine other corrosion-resistant alloys were tested in hot acetic acid vapors containing traces of oxidizing contaminants. HASTELLOY alloy C had a penetration rate of only 0.0007 inches per year—lowest among all nine competitive alloys. Others varied from 0.005 to 0.5 inches per year and were severely pitted. This test showed one manufacturer of organic chemicals how he could keep his maintenance costs to a minimum before a process was even on stream.

How much money can you save in your plant? Why not find out for sure by testing HAYNES alloys.

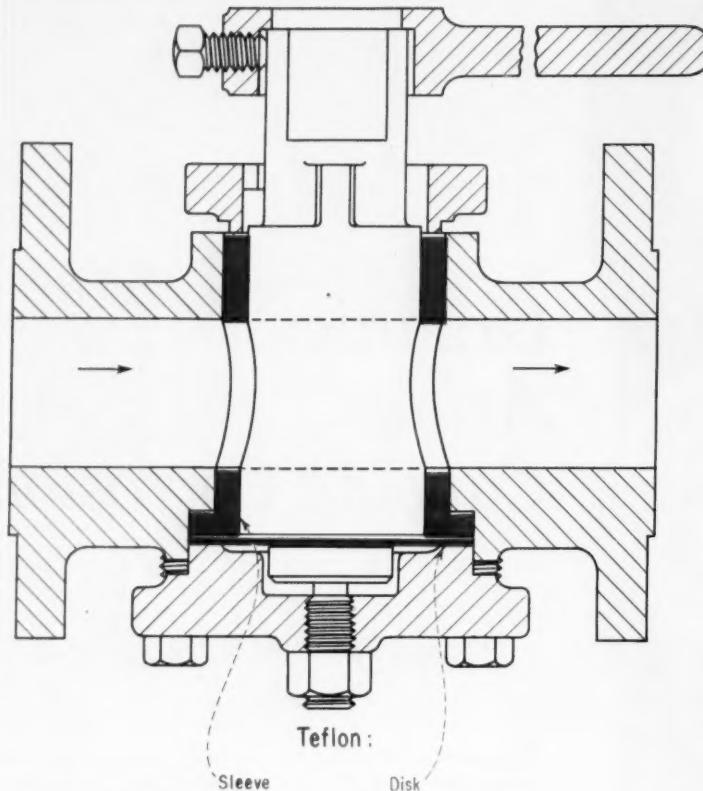
We'll gladly send you samples. There are 6 HAYNES corrosion-resistant alloys. To help us select the one most likely to solve your problem, we suggest that you send us a letter outlining the corrosive conditions in your plant. To learn more about HASTELLOY alloys, ask for a copy of our 104-page book. It describes the alloys in detail.

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Union Carbide Corporation  
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The terms "Haynes," "Hastelloy," and "Union Carbide" are registered trade-marks of Union Carbide Corporation.



**OPEN AND SHUT:** plug valve with Teflon sleeve needs no lubrication, but can't take extreme temperatures.

resulting wire drawing and erosion of the gate in the partly open position.

The least required of the perfect on-off valve is that it have a tight stuffing box which permits low leakage to the outside (valve open most of the time) and that it provides positive shut-off (valve closed the majority of the time).

From the standpoint of operation, putting aside maintenance and other considerations for the moment, the chemical valve which comes closest to this ideal is the nonlubricated plug cock with Teflon sleeve.

► **Keeps Leakage Low**—In process service, particularly when toxic, flammable, corrosive or costly liquids are involved, external leakage or escape of process fluid to the outside is to be avoided. This, of course, is what has to be guarded against when the valve is open. The nonlubri-

cated Teflon-sleeved valve mentioned above is absolutely tight in this respect.

Basic closure is effected by the horizontal vector of the upward force of the bolted bottom cap acting on the plug. Although not needed on valves 1-in. and below, larger valves are equipped with a top cap or gland which contacts the sleeve at the top.

The other end of the sleeve is still more positively designed to prevent leakage. Result is essentially the same as if it were a conventional plug valve with no aperture in the bottom of the body. First, the liner flange fits into the counter-bore in the body and pressure is constantly maintained on this flange by the raised portion of the bottom cap. Secondly, extending over the entire opening at the bottom, with its diameter equal to the O.D. of the liner flange and inserted between the liner flange and bot-

tom cap, is a Teflon diaphragm or circular piece of Teflon.

► **Tight Shutoff**—Another major requisite of the good on-off valve is tight shutoff. This is what is wanted when the valve is to be in the closed position most of the time.

In the standard gate valve, closure is effected by forcing the gate down between the seats. In stainless steel this is poor metallurgical design because of the well-known tendency of austenitic stainless steel to gall and seize when in contact. Differential hardness can overcome this but then comes the problem of finding a material which will have corrosion resistance as well as hardness—a tough one to solve.

Furthermore, should any solids accumulate in the trench below the gate, gate travel is limited and the valve won't shut off. With the stainless steel plug valve, there is no possibility of galling as the plug is completely separated from the body by the Teflon sleeve.

Solids aren't a problem. It can easily handle slurries. Another advantage the plug valve has over the gate is it is quick operating—1 turn from full-open to close—a matter of seconds rather than minutes.

These are functional comparisons of the self-lubricated plug cock and gate valve when used on on-off or stop-valve services. Of the additional features of this valve, one, or more, or all will be of interest depending upon individual applications. For example, there are no pockets and no holdup.

► **Some Limitations**—As far as limitations are concerned, temperature is the main drawback. Top temperature is about 400 F.

Temperature also comes into the picture in another way. Extreme and repeated temperature fluctuations have a deleterious effect on a pure Teflon sleeve. This problem, however, has been overcome for most such situations by dispersing throughout the molding powder one of several inert reinforcing agents, depending upon the solution being handled. Pressure is limited to 300 lb. Size, also, presents a problem—sometimes 6-in. is tops. ► **Easy Maintenance**—Maintenance-wise this plug valve has it

# TYPE **K**

# **Y** VALVES



**At HEYDEN NEWPORT  
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Bay Minette, Ala., these Durco

Type K "Y" valves have been handling

**SULFURIC ACID AND BLEACH SOLUTION**

for almost three years with virtually no maintenance.

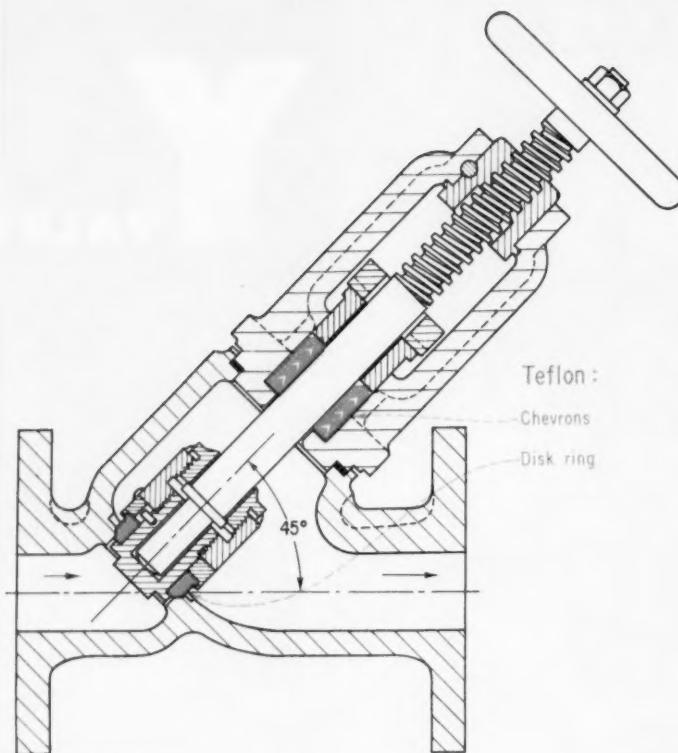
Durco Type K "Y" valves provide positive closure without galling; maximum flow with minimum pressure drop; positive sealing at the stem with Teflon V-ring packing; renewable seat and disc ring of Teflon, Durimet 20, Duriron, or other alloys; and all stainless trim. The gland design utilizes rolling point contact of the gland follower, insuring proper pressure distribution and preventing stem scoring. Unique disc assembly permits renewal of disc ring, prevents failure in service, and extends valve life.

Durco Type K "Y" valves are available in Durimet 20, Durco 18-8-S-Mo, Monel, Nickel, Chlorimet 2, and Chlorimet 3. Complete details of construction are contained in Bulletin V/7a.



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**THROTTLING:** Y-valve design avoids sharp pressure drop; Teflon disk defeats erosion and wear problems.

all over other stop valves. Its design is simple, there is a minimum number of parts. It is easy to take apart and put back together. There is but one adjustment (note the adjusting screw in sketch) and that need only be made occasionally. Unlike other valves, there is no stem packing to be replaced. Actually, the only wearing part (the plug rotates in the stationary sleeve) is the Teflon sleeve. Experience has shown this part to be tough and erosion-resistant.

Also, as Teflon is inherently slippery and self-lubricating, there is no need for lubrication as there is with the conventional lubricated plug cock. One big reason why lubricated plug cocks found disfavor in many plants in years past is that they were never given the lubrication they required.

When it eventually becomes necessary, the sleeve can be easily replaced. And sleeves are interchangeable between valves of the same size.

► **For Throttling**—So much for the valve to handle on-off jobs. The other out-of-the-ordinary valve is the Y valve, one that is often used in place of globe valves on throttling services. It combines the best features of a good gate and a good globe valve.

#### Y-Valves: for Throttling Service

Closure is effected by the plug moving up to and closing its body opening. So throttling characteristics are essentially the same as the globe. However, liquid passing through the valve makes two 45 deg. turns rather than two 90 deg. turns as in the globe valve. Pressure drop in the wide open position is only about 1/7 that through the wide-open globe valve (2-in. valve, full open, 200 gpm., 2½ psi.). Accompanying advantages are less turbulence, erosion and wear.

Interesting design features include the removable Teflon disk ring. Slight side play of the disk assembly on the stem allows the rounded stem to seat the disk

perfectly. The tapered, confined, Teflon disk ring contacts the tapered metal seat. No galling or wire drawing can take place.

Stuffing box design, too, is such that maximum packing life results. The highly polished stem rotates against the slippery Teflon chevrons. But what is most effective is the positioning of the rings themselves. At the bottom of the box is a flat adapter ring which seats squarely. At the top, the notched gland engages the first ring and keeps it in perfect alignment—only slight follower pressure is necessary to spread the chevrons in toward the stem and out against the box. As the two-point contact rocker-type gland follower exerts its force parallel to the stem, gland cocking and stem scoring don't take place.

► **Can Handle Slurries**—Not only throttling services but also slurries can be handled most satisfactorily by this valve. That part of the disk assembly which is exposed directly to the impinging liquid is a heavy, cast section. Unlike the conventional globe valve, there are no stem threads or disk nut at this point. On corrosive services, incidentally, these threads not only become eroded badly but also are very susceptible to corrosion. In stainless steel they gall and make the task of valve repair more difficult. Again in slurry services, the remarkable properties of Teflon come into the picture. The tough, fibrous disk ring strongly resists erosion. It is so slippery that solids don't stick to it.

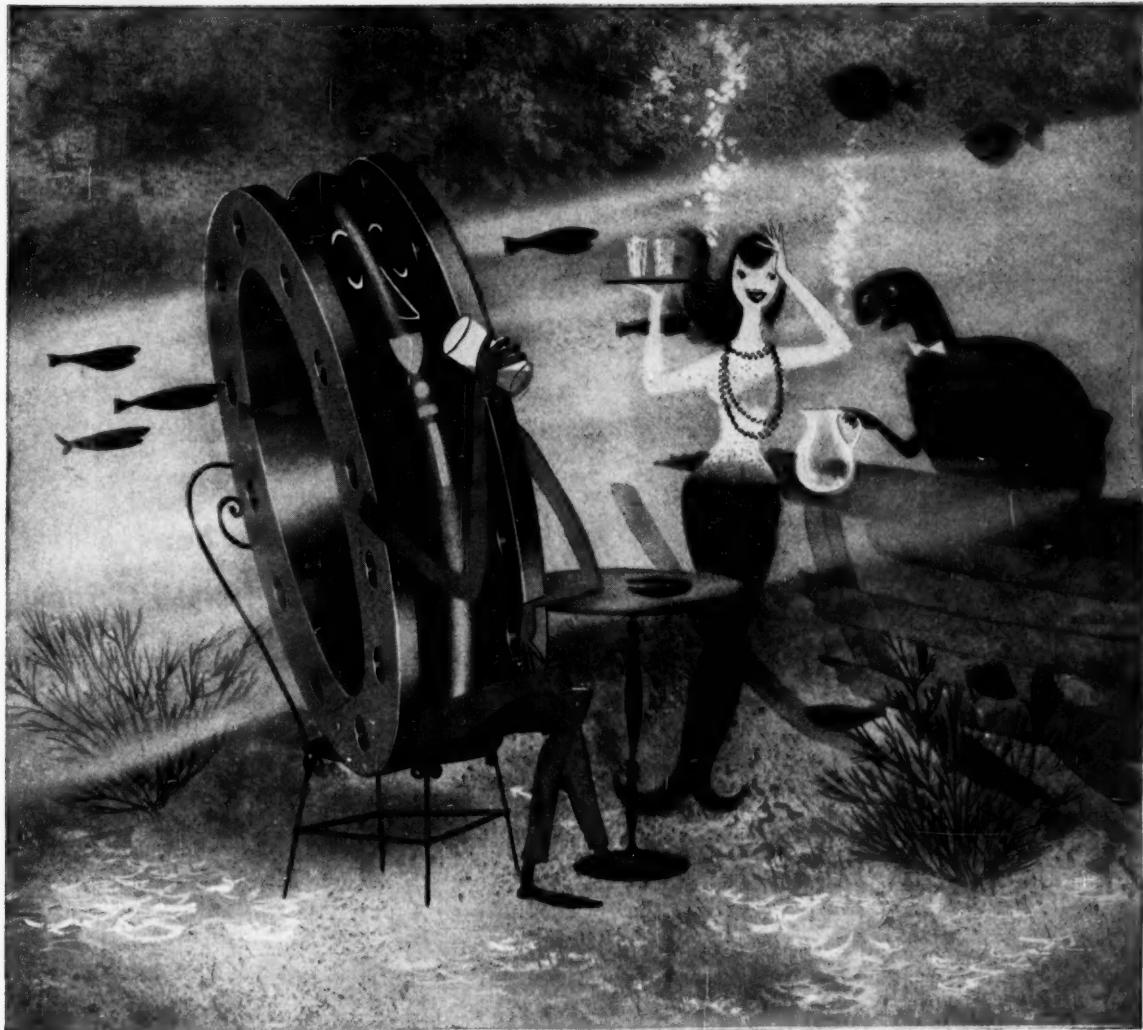
**Two-piece body:** for erosive-corrosive slurries, the seat ring can be furnished in high-silicon iron, which is very hard and extremely corrosion resistant as well. As another example, the seat ring can be Teflon—and the combination of Teflon disk ring and Teflon seat ring happens to be ideal for hydrofluoric acid.

---

R. B. WOOSTER is N. Y. district manager for the Duriron Co. He holds a B.S. in chemical engineering from M.I.T. Mr. Wooster worked for Du Pont in production, process development and technical sales before joining Duriron.



EXPANSION JOINTS



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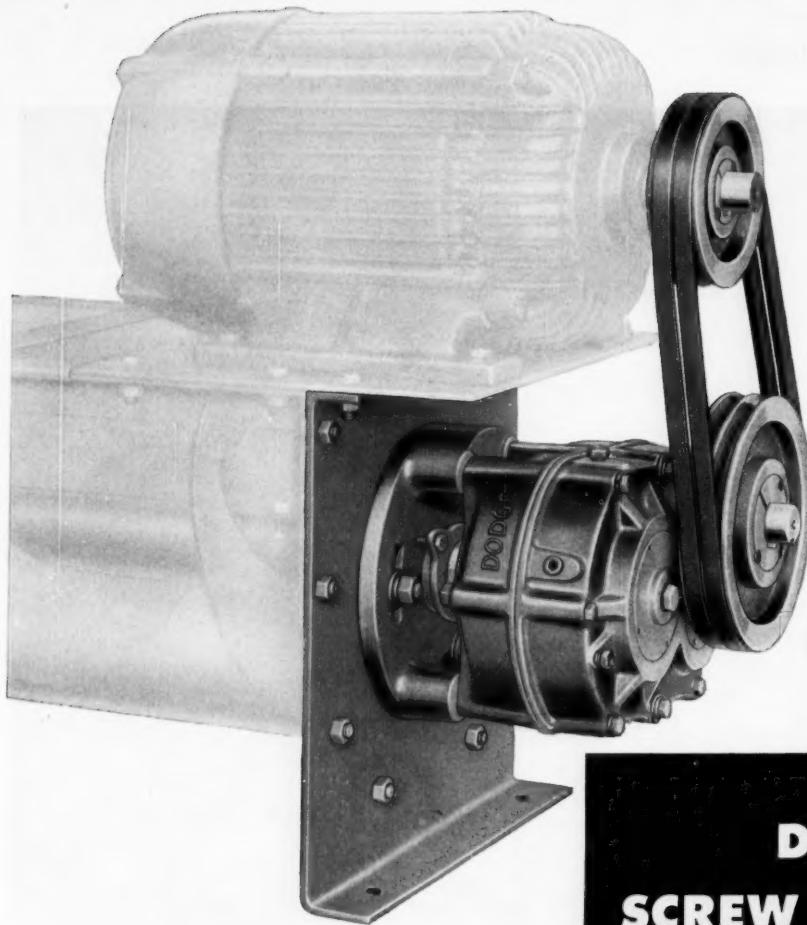
Mechanical Goods Division

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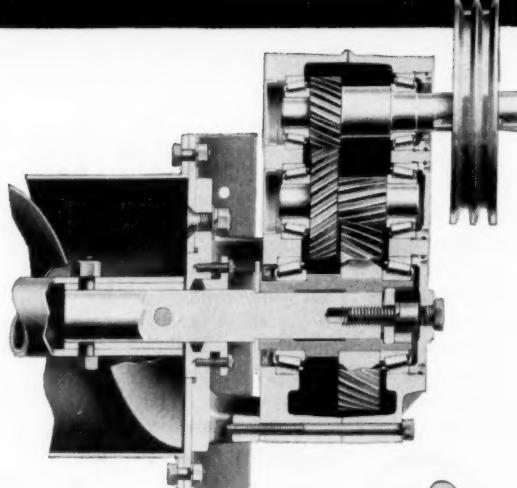
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## FIRMS IN THE NEWS

R. A. LABINE

### NEW FACILITIES

#### April's Top Projects:

**Magnolia Petroleum** will build ethylene plant at Beaumont, Tex., with annual capacity of 380 million lb. First phase of construction calls for a \$25-million outlay; M. W. Kellogg is general contractor. To be completed early in 1961, unit will also produce propylene and butadiene.

**American Potash & Chemical** will start construction late this year at Trona, Calif., on first commercial plant for making boric oxide—used in high-energy fuels. Cost: about \$800,000. Boric acid capacity will also be expanded at Trona.

**Pacific Engineering & Production Co.**, Henderson, Nev., is going into production of ammonium chlorate. Plant capacity is not announced, but unit will use a "modified electrolytic process."

**Esso Standard Oil** has signed agreement with the government of Jamaica to build a 26,000-bbl./day refinery on the island. Investment will be around \$18-20 million.

**Duval Sulfur & Potash Co.** has started production at its new \$20-million copper mine and mill 30 mi. south of Tucson, Ariz. Production rate is scheduled at 10,000 tons/day.

**Reichhold Chemicals** has construction under way at Tacoma, Wash., on the initial \$250,000 unit of a plant for producing water-soluble resins. No figure is given on capacity, but plant will have two reactors—compared to four at its nearby Seattle plant.

**Barcon, Inc.**, has placed a new \$300,000 lignin liquor processing plant in operation at Appleton, Wis. Unit produces dry, powdered lignin products. Barcon is owned jointly by Consolidated Water Power & Paper Co. and Magnet Cove Barium Corp.

**Monsanto Chemical** has its new Mersize plant on stream at

Nitro, W. Va. Unit is integrated with rosin raw material supply from an adjacent tall oil fractionating plant (*Chem. Eng.*, Aug. 25, 1958, pp. 58-60). Mersize is a chemically fortified pale rosin size used to waterproof paper and paper board.

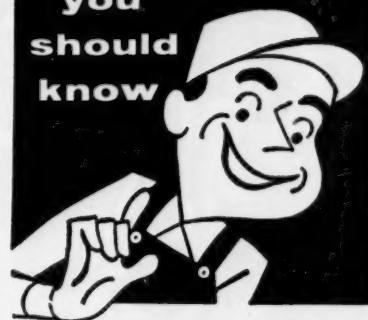
**Best Fertilizer Corp.**'s new ammonia plant at Lathrop, Calif., is now completely on stream, company reports. Plant, which is officially rated at 117 tons/day, is now producing 125-130 tons/day.

**Cyanamid of Canada** is converting its Niagara Falls, Ont., plant from U. S. coal to western Canada natural gas for raw material. Plant produces ammonia and ammonium nitrate. Conversion will cost \$5 million.

**Fluor Corp. of Canada** has been awarded a \$3-million contract to engineer and build a gas

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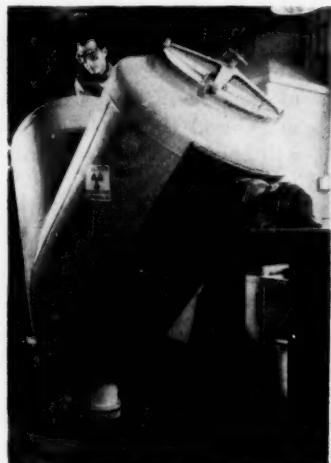
Your nearest Williams representative will be glad to provide you with full technical data and samples, or write Dept. 62, C. K. Williams & Co., Easton, Penna.

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## FIRMS

processing plant for the Nevis Operators' Committee at Nevis, Alta. When completed in November, plant will yield about 43 million cu. ft./day gas and 125 long tons/day of sulfur.



**Spencer Chemical** plans to erect a plant at its Jayhawk Works near Pittsburg, Kan., to produce 50 tons/yr. uranium dioxide via a new continuous process. Rotary blender above is used to blend  $UO_2$  fuel prior to shipping to fuel element fabricators.

**Sun Oil** is building a \$100,000 product control center at its Marcus Hook, Pa., refinery. When completed later this month, facility will collect and monitor continuously the variances in characteristics in product streams, aiming at greater efficiency in controlling refining processes and improved product quality.

**Ferro Corp.**, Cleveland, Ohio, has just concluded negotiations for establishing a new overseas affiliate in Bilbao, Spain. New plant, owned jointly with Union Quimica Del Norte De Espana, will produce porcelain enamel, glaze frits and inorganic colors.

**Sandia Corp.**, a nonprofit subsidiary of Bell System's Western Electric Co., has opened an atomic ordnance laboratory near Livermore, Calif.

# ACCURATE!

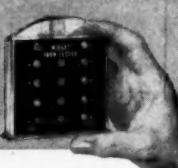
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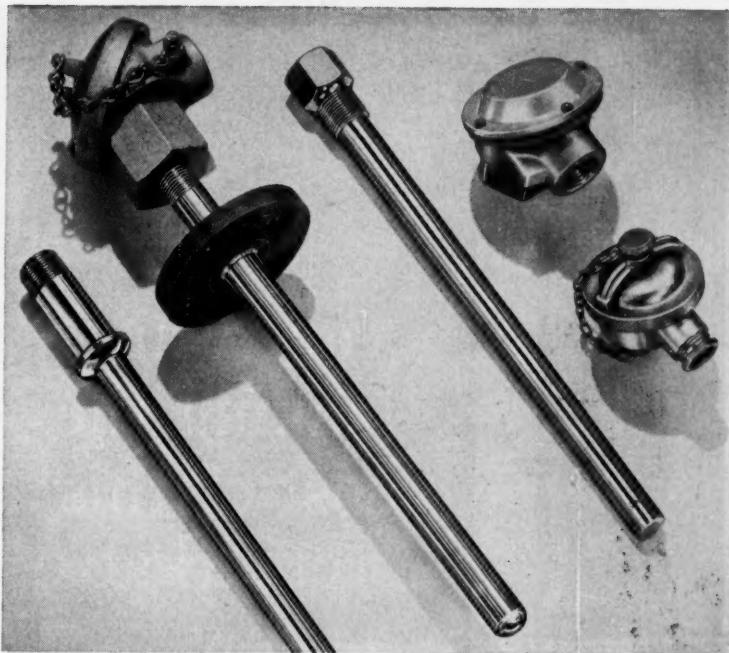
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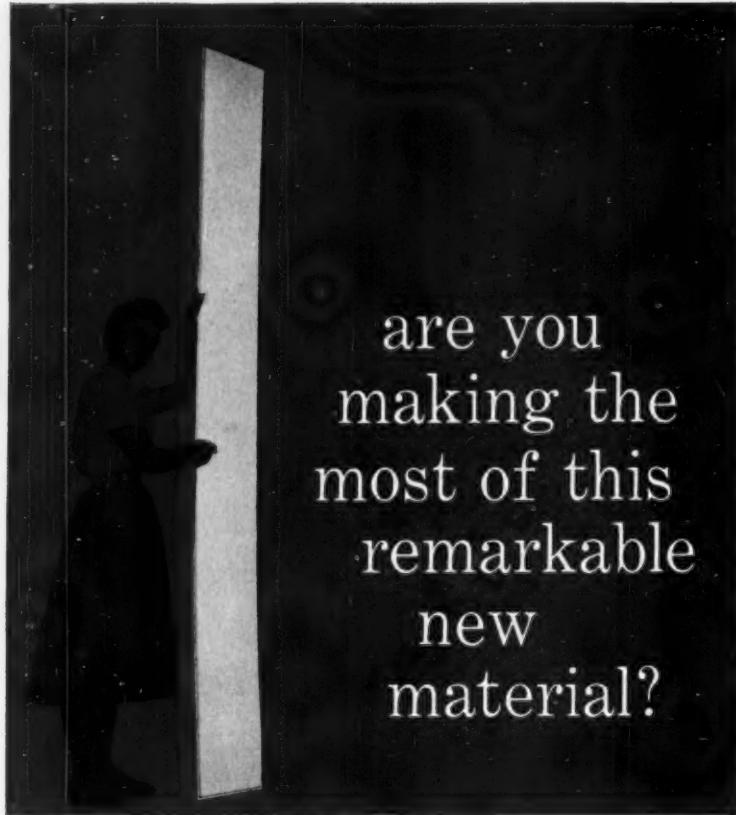
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### FIRMS . . .

The \$7-million installation will design and develop non-nuclear components of atomic weapons and will work closely with the nearby Ernest O. Lawrence Radiation Laboratory.

**American Cyanamid** is establishing a million-dollar basic research laboratory in Geneva, Switz. To be staffed entirely with European scientists, the lab will serve as an "idea factory" taking full advantage of European methods for conducting research.



**A. P. Green Fire Brick Co.** recently expanded its research and testing facilities by installing eight natural gas reheat furnaces and three Leeds & Northrup cam-type control systems. Operator above reads start-up temperature from panel.

**Husky Oil**, Cody, Wyo., has acquired half-interest from Canadian Husky Oil in 50,000 acres near McMurray, Alta., in Athabasca tar sands region, where it hopes to apply results of Swedish Shale Oil's and Union Oil's research in tar sands oil recovery at Santa Cruz, Calif.

**Kennecott Copper** is spending \$10 million renovating the Garfield, Utah, copper smelter formerly owned by American

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The 200-pound Kidde pressurized wheeled unit discharges a 40-foot dry chemical stream faster, has an *extra* 50 pounds of fire-smothering dry chemical to knock down fire quicker. It's faster and easier to operate . . . just remove pin, swing toggle lever, and flip on-off lever. Easy to maneuver because of its low center of gravity and larger wheels. Truly a one-man fire engine!

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**HERE'S WHY:** You can order in quantity and in a wide variety of sizes—and be certain of complete uniformity throughout. Our strict density control assures you thoroughly non-porous Teflon—free from any flaws which might possibly affect your end use or product. Dimensions are accurate to your most critical tolerances—no rejects, waste of material or loss of time. You get product purity—Teflon at its best in every one of its remarkable characteristics. Delivery is prompt—you get the quantity you want when you want it.

Since the availability of Teflon, "John Crane" engineers have worked with Industry to successfully solve innumerable problems and develop new applications. You can benefit from their experience and know-how.

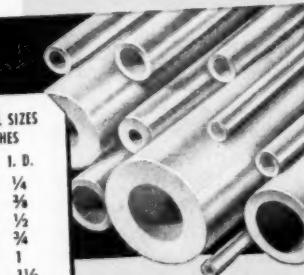
Thickness Inches	Nominal Size
1/16	12 x 12
3/32	18 x 18
1/8	24 x 24
5/16	36 x 36*
1/4	48 x 48*
3/8	
1/2 & Up	

\* Can be furnished  
in 1/2 sheets

## SHEET

DIAMETER INCHES
1/4
5/16
3/8
7/16
1/2
9/16
5/8
3/4
7/8
1
1 1/2
2
2 1/2
3

Other diameters  
on specification



## TUBING

### Characteristics of Teflon

#### CHEMICAL

Completely inert.

#### ELECTRICAL

Very high dielectric strength.  
Extremely low power factor.

#### THERMAL

Temperature range  
-300° to +500° F.

#### MECHANICAL

Strong, flexible, weather  
resistant.

#### LOW COEFFICIENT OF FRICTION

Absolutely non-stick.

\* DuPont Trademark



Request full information and ask for our bulletin, *The Best in Teflon*.

Crane Packing Co., 6451 Oakton St., Morton Grove, Ill.  
(Chicago Suburb)

In Canada: Crane Packing Co., Ltd., Hamilton, Ont.

**CRANE PACKING COMPANY**



### FIRMS . . .

**Smelting & Refining.** Principal change will be "green firing" of ore concentrates direct to reverberatory furnaces rather than roasting first. Kennecott will eliminate the 48 roasters, fire concentrates by conveyor belt directly to the top of the five furnaces.

**Electric Reduction Co.**, Toronto, Ont., is now in production of phosphates at Buckingham, Que., and is proceeding with the next stage in its Eastern Canada expansion program: A "multimillion-dollar" outlay for plants to make sulfuric and phosphoric acids as well as sodium phosphates and related products. Plants will be located at Port Maitland, Ont.

**Celgar Development Co.** is getting construction under way on the main units of its new \$50-million pulp and sawmill project in the Kootenay Valley of British Columbia.

**Atomic Energy Commission** has signed a contract with Western Nuclear Corp., Rawlins, Wyo., increasing capacity of firm's mill at Split Rock from 400 tons/day to 850 tons/day.

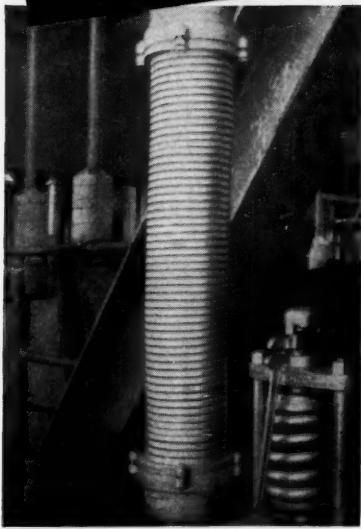
**Battelle Memorial Institute**, underscoring the potential importance of plutonium fuel elements, plans to erect a new laboratory outside Columbus, Ohio, devoted to plutonium studies. Research will center on applications of plutonium as fuel in central station power reactors.

**Calumet & Hecla's Wolverine Tube Div.** has tripled research facilities at Allen Park, Mich., for materials development for missile and atomic energy fields. Materials under study have high heat strength or low neutron absorption properties.

**Texas Gulf Sulphur** has obtained a five-year option on lithium mining properties in North Carolina under agreement with Basic Atomics, Inc. Agreement also covers five-year option on patent

# PENFLEX

- CUSHIONS SHOCK
- PREVENTS BREAKS



## PENFLEX TUBING ABSORBS THERMAL EXPANSION SHOCKS

Thermal expansion 900°F... pressures up to 850 psi... impact and pipe movement under terrific strain, but Penflex safely handles them all. That's the story of Penflex 8" I.D. stainless steel interlocked tubing welded into the pipeline, eliminating the cost of flanging the joint as well as the pipe. This was installed as an expansion joint on safety blow-off valves.

Wherever thermal expansion, pressures and shock are factors in keeping steam, air, water or chemical lines from breaking you can rely on Penflex Interlocked Tubing and Penflexweld High Pressure Tubing. Available in steel, bronze and stainless steel from  $\frac{1}{2}$ " I.D. to 24" I.D. Write for complete details to Pennsylvania Flexible Metallic Tubing Company, Inc., 7234 Powers Lane, Philadelphia 42, Pa.

GET NEW  
DATA BOOK  
AND CATALOG



# PENFLEX

TIGHT AS A PIPE BUT...  
FLEXIBLE

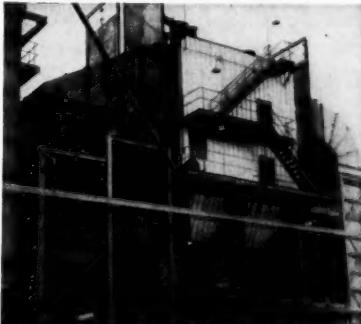


**This  
Cyclone  
won't  
clog or  
plug**

Buell's exclusive 'Shave-off' design permits large diameter cyclones that will not clog, plug, or bridge when properly operated: you avoid unnecessary maintenance work or process interruptions.

The unique Shave-off port traps the dust that whirls upward in double-eddy currents, increases cyclone efficiency by eliminating this source of dust reentrainment. Whether installed singly or in groups, Buell Cyclones are the most efficient ever developed.

Other features include extra heavy plate construction for longer service life, Buell-designed manifolds for more efficient, non-turbulent flow of dust-laden gases... and the confidence assured by a history of hundreds of installations everywhere in America. Write for a copy of the 12-page booklet, "The Exclusive Buell Cyclone": Dept. 12-D, Buell Engineering Company, Inc., 123 William St., New York 38.



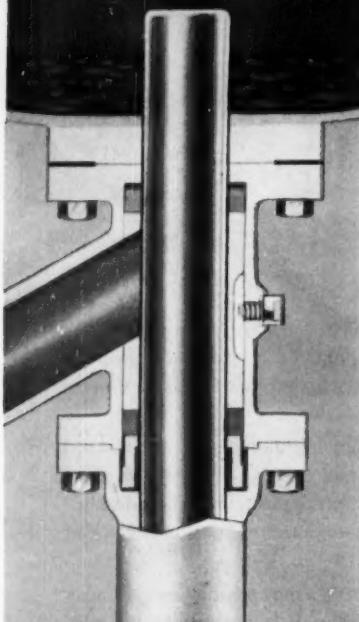
Large-diameter Buell Cyclones in series with Buell 'SF' Electric Precipitator.

**bue**ll

Experts at delivering Extra Efficiency in  
**DUST COLLECTION SYSTEMS**

*a*  
FLUSH BOTTOM VALVE  
*that*  
WILL NOT CLOG UP.

Designed for Chemical and  
Pharmaceutical Industries



## Strahman RAM TYPE Drain Valves

The Strahman Drain Valve is the only valve that cannot clog up. It is so designed that in the closed position the piston or ram extends up into the tank thus preventing any possibility of the outlet becoming plugged.

In the open position, full and unobstructed flow is assured as the piston is drawn down into the bonnet leaving a completely open passage for the material passing through.

Write direct for complete catalogues



**STRAHMAN**  
VALVES, INC.  
16 HUDSON STREET  
NEW YORK 13, U.S.A.

### FIRMS . . .

rights on a process for recovering lithium from spodumene-bearing ores and concentrates.



**Combustion Engineering** has acquired General Nuclear Engineering Corp.; General Nuclear will operate as a subsidiary of Combustion Engineering and will have charge of the company's nuclear power activities.

**Dow Chemical** has formed an overseas subsidiary, Dow Chemie Aktiengesellschaft, in Basel, Switz., to finance Dow's expanding overseas interests. Company was incorporated with initial paid-in capital of \$5.8 million.

**Witco Chemical** has purchased controlling interest in P. N. Soden & Co., Canadian chemical distributors. Move enables Witco to expand its chemical sales and manufacturing activities in Canada.

**Colgate-Palmolive** has completed negotiations for purchase of the Wildroot Co.; Wildroot will now operate as a subsidiary of Colgate-Palmolive.

**E. F. Drew & Co.** has acquired the Malaga Oil Products Co. of Lindsay, Calif., and the Strathmore Oil & Fat Co. of Strathmore, Calif. Strathmore now becomes a wholly owned subsidiary and Malaga will operate as a division of Drew.

**Polycraft Bag Co.** is a new firm headquartered in South Bend, Ind., that will soon be manufacturing heavy-duty polyethylene bags in a new plant now under construction in South Bend.

**Spencer Chemical Co.**'s joint venture with Industrial Rayon Corp. to make caprolactam



"Did you know that semiconductors improve the performance of radios and TV's, too?"

## *Seriously speaking . . .*

Semiconductor devices such as transistors, diodes and rectifiers improve the performance and reliability of radios, TV sets, hearing aids, computers and missiles and also make possible many other electronic devices.

**Mallinckrodt** . . . called in early to develop fine chemicals for the electronics industry . . . provides an extensive line of special-purity TransistAR<sup>®</sup> chemicals to help manufacturers maintain the extremely low impurity levels necessary for successful production of semiconductor devices.

Electronics is only one of many industries which rely on **Mallinckrodt** process chemicals, manufactured to strict specifications to meet particular production needs.

### LINKING CHEMISTRY TO INDUSTRY

**Mallinckrodt**<sup>®</sup>

MALLINCKRODT CHEMICAL WORKS  
ST. LOUIS • NEW YORK • MONTREAL

has been called off due to the planned entry of another "large chemical company" (Du Pont) into the field. Spencer is retaining the plant site at Ashland, Ky., but says that it has no immediate plans for the site.



#### OVERSEAS BRIEFS

**Montecatini**, Milan, Italy, and the Yugoslav Rudnap Company have signed an agreement for construction of an \$8.5-million fertilizer plant at Lukavaz. Plant will produce 100 metric tons/day ammonia, 340 tons/day nitric acid and 380 tons/day ammonium nitrate. Montecatini is also building at Brindisi, Italy, a \$90-million petrochemical plant that will process 1 million tons/yr. liquid hydrocarbons into a wide range of derivatives.

France will have 50,000 tons/yr. more synthetic rubber capacity when the new plant at Berre Lake, Near Marseilles, comes on stream. Plant will be built by a new company formed by the Royal Dutch Shell Group.

**India** has awarded a \$16-million contract to the German firm of Frederick Uhde for construction of an ammonium fertilizer plant at Rourkela. Plant will have an estimated output of 600,000 tons/yr. and will be on stream by end of 1961 using coke-oven gas as a source of hydrogen for ammonia.

**Poland** will build a new petroleum refinery at Plock, 25 mi. west of Warsaw. Construction is slated to start during 1960; initial capacity will be 2 million metric tons/yr. Refinery will decrease Poland's oil products imports and will provide the basis for a domestic petrochemical industry.

**We  
have  
moved**



... and here are our new offices —

**170 GREAT NECK ROAD  
GREAT NECK, NEW YORK  
Phone: HUnter 2-5200**

With our constantly expanding business has grown the need for larger office quarters to serve you better than ever.

From our new location we will continue to respond promptly to your inquiries for

**Heliflow Heat Exchangers  
Steam Jet Ejectors  
Steam Vacuum Refrigeration  
Surface Condensers  
Barometric Condensers  
Monobolt Heat Exchangers  
Evaporators  
Deaerating Heaters**

#### Engineers Wanted!

We have a limited number of positions with a real future open to qualified vacuum and heat transfer engineers. Please send your application to our new address above.

**GRAHAM MANUFACTURING CO., INC.**

**Heliflow Corporation**

(Formerly located at 415 Lexington Ave., N. Y. 17, N. Y.  
and our phone number was MUrray Hill 2-8770)



# Project:

a welded  
aluminum seam

SAFE enough to hold

# HCN

## ... BOARDMAN DID IT!

Specifications of a major chemical processor, for a series of hydrocyanic acid converters, included cones of 6061-T6 aluminum welded to flanges of 5052 aluminum plate. This meant that each extremely difficult weld must pass a water-clear X-ray test; zero porosity! HCN must not escape!

The processor's engineers, were well aware of the problems involved. But they knew BOARDMAN-ability and they knew their exacting specifications would be precisely met; that this tricky fabrication job would be satisfactorily completed.

After exhaustive technique research in consultation with aluminum producers—and working with infinite cleanliness and care—the cones were made and the converters completed, HCN-safe!

BOARDMAN DID IT. No matter how demanding your project may be, BOARDMAN can do it to your complete satisfaction. Call us, collect, for consultation on your chemical process project.

# BOARDMAN

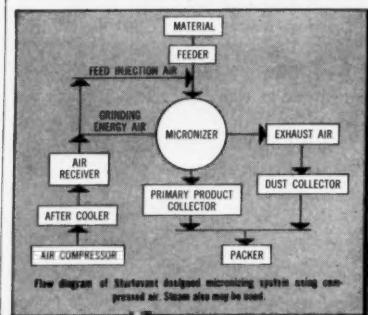
THE BOARDMAN CO.  
OKLAHOMA CITY, OKLAHOMA

Write for the brochure, "Working with metal . . . at Boardman"



## Need $\frac{1}{2}$ to 44 Microns?

Sturtevant Micronizers\*  
Make 325 Mesh Obsolete



### One Operation Reduces, Classifies

Sturtevant Micronizers grind and classify in one operation in a single chamber—provide fines in range from  $\frac{1}{2}$  to 44 microns to meet today's increased product fineness needs. Can handle heat-sensitive materials.

Production Model  
(15 in. chamber)

### No Attritional Heat

Particles in high speed rotation, propelled by compressed air entering shallow chamber at angles to periphery, grind each other by violent impact. Design gives instant accessibility, easy cleaning. No moving parts.

### Classifying is Simultaneous

Centrifugal force keeps oversize material in grinding zone, cyclone action in central section of chamber classifies and collects fines for bagging. Rate of feed and pressure control particle size.

### Eight Models Available

Grinding chambers range from 2 in. diameter laboratory size ( $\frac{1}{2}$  to 1 lb. per hr. capacity) to large 36 in. diameter production size (500 to 4000 lbs. per hr. capacity). For full description, request Bulletin No. 091.

### Engineered for Special Needs

A 30 in. Sturtevant Micronizer is reducing titanium dioxide to under 1 micron at feed rate of 2250 lbs. per hr. For another firm, a 24 in. model grinds 50% DDT to 3.5 average microns at a solid feed rate of 1200-1400 lbs. per hr. A pharmaceutical house uses an 8 in. model to produce procaine-penicillin fines in the 5 to 20 micron range. Iron oxide pigment is being reduced by a 30 in. Micronizer to 2 to 3 average microns.

Sturtevant will help you plan a Fluid-Jet system for your ultra-fine grinding and classifying requirements. Write today.

### Can Test or Contract Micronizing Help You?

Test micronizing of your own material, or production micronizing on contract basis, are part of Sturtevant service. See for yourself the improvement ultra-fine grinding can contribute to your product. Write for full details.  
STURTEVANT MILL CO., 100 Clayton St., Boston, Mass.



\*REGISTERED TRADEMARK OF STURTEVANT MILL CO.

## CALENDAR

Instrument Society of America, Second National Symposium on Instrumentation.  
April 6-7 St. Louis, Mo.

American Institute of Mining, Metallurgical and Petroleum Engineers, 42nd national Open Hearth Steel Conference and Raw Material Conference, Jefferson Hotel. April 6-8 St. Louis, Mo.

American Institute of Chemical Engineers, Ohio, Pittsburgh and West Virginia Sections, annual symposium: Catalysis, Mellon Institute. April 10 Pittsburgh, Pa.

National Petroleum Assn., semi-annual meeting, Hotel Cleveland. April 15-17 Cleveland, Ohio.

Engineering, Marine Welding and Nuclear Energy Exhibition. April 16-30 Olympia, England

American Oil Chemists Society, 50th Anniversary Meeting, Roosevelt Hotel. April 20-22 New Orleans, La.

Natural Gasoline Assn., of America, 38th annual convention, Baker and Adolphus Hotels. April 22-24 Dallas, Texas

13th Annual Power Sources Conference, Shelburne Hotel. April 28-30 Atlantic City, N. J.

Electrochemical Society, 115th national meeting, Sheraton Hotel. May 3-7 Philadelphia, Pa.

American Society of Mechanical Engineers, Maintenance & Plant Engineering Division conference, Edgewater Beach Hotel. May 4-5 Chicago, Ill.

American Institute of Chemists, annual meeting, Hotel Traymore. May 6-8 Atlantic City, N. J.

International Petroleum Exposition. May 14-23 Tulsa, Okla.

American Institute of Chemical Engineers, Hotel Muehlebach. May 17-20 Kansas City, Mo.

Chemical Specialties Manufacturers Assn., Drake Hotel. May 18-20 Chicago, Ill.

Commercial Chemical Development Assn., annual resort meeting, Pocono Manor. May 25-26 Pocono Mts., Pa.

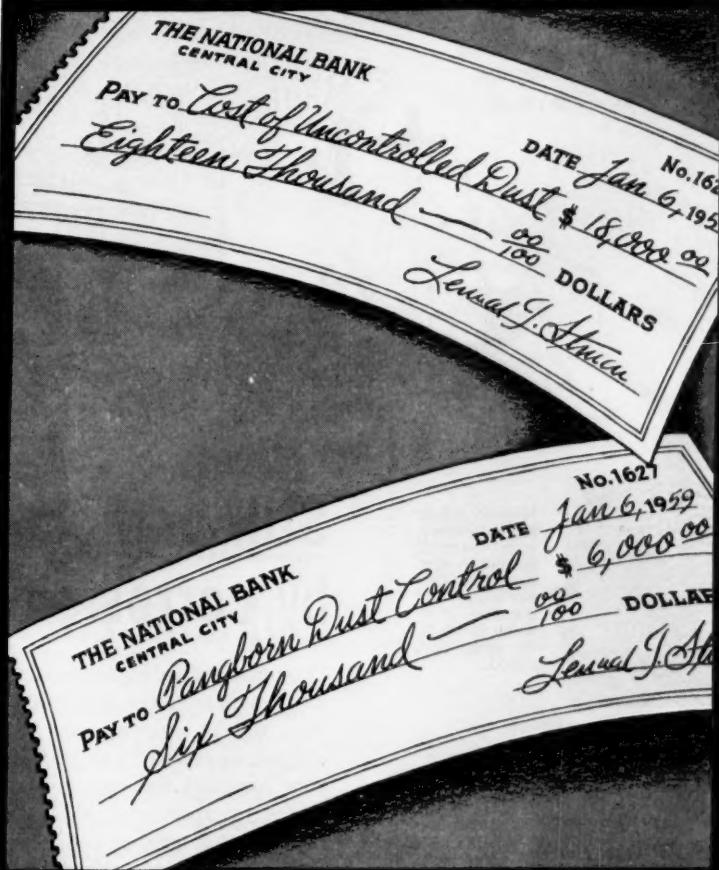
Chemical Inst. of Canada, 42nd annual conference, Nova Scotian Hotel. May 25-27 Nova Scotia, N. S.

American Society of Mechanical Engineers, Design Engineering Conference, Convention Hall. May 25-28 Philadelphia, Pa.

American Petroleum Institute, Refining Div. midyear meeting, Hotel Statler. May 27-30 New York, N. Y.

Fifth World Petroleum Congress, Coliseum. May 31-June 6 New York, N. Y.

# WHICH CHECK WOULD YOU RATHER WRITE?



How much  
are you  
paying  
for  
uncontrolled  
dust?

See for yourself—add up the cost of your lost salvageable material, housekeeping expenses, excess machine wear, intangibles such as community and employee goodwill. Whether your total is moderate or high, Pangborn Dust Control will cost you less than uncontrolled dust.

For details on Pangborn's engineering knowledge and experience, talk to the Pangborn man in your area or write PANGBORN CORPORATION, 2600 Pangborn Blvd., Hagerstown, Maryland. Manufacturers of Dust Control and Blast Cleaning Equipment — Rotoblast® Steel Shot and Grit.

**Pangborn**

**CONTROLS  
DUST**

**Life in these excited states...**

"I got the pot and tubing corrosion licked, but now the jugs won't hold up!"



"WAM" PUMP  
finest you can buy

Highest pumping efficiency, with faultless corrosion resistance. Hard rubber casing and impeller; Hastelloy C shaft. 80 gpm. Bul. CE-55.



LIQUIDS never touch metal in Ace diaphragm valves! Rubber or plastic-lined cast iron, or solid plastic bodies. Sizes  $\frac{1}{2}$  to 6". Ask for facts.

## Still bothered by corrosion?

Downtime, ruined equipment, endless repairs are more than disturbing...they're expensive too. You can put an end to 85 to 100% of your corrosion and contamination losses by specifying chemical-resistant Ace rubber and plastic equipment...pipe, valves, tanks, pumps. American Hard Rubber Company's 108 years of experience is ready to help you with any problem.



High-impact, rubber-plastic, most economical for average chemicals.  $\frac{1}{2}$  to 6". Screw or solvent welded fittings. Valves  $\frac{1}{2}$  to 2". NSF-approved. Bul. 80A.



All-purpose rigid PVC. Sched. 40, 80 & 120,  $\frac{1}{2}$  to 4". Threaded or socket-weld fittings. Valves  $\frac{1}{2}$  to 2". NSF-approved. Free Bul. CE-56.

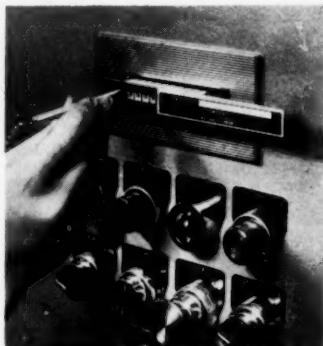


**ACE** processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY  
DIVISION OF AMERACE CORPORATION  
Ace Road • Butler, New Jersey

NEW EQUIPMENT . . .

(Continued from p. 104)



### Batching System

Change of a plug-in unit alters plant operation.

Incorporating a new formula-control component called the Batchplug, a new automatic batching system developed by The Howe Scale Co. provides instant formula changes while eliminating the human errors that sometimes occur in manual ingredient-dialing systems.

Each Batchplug contains electrical circuitry that can program sequential control of up to ten ingredients on as many as three separate scales. Batchplugs are about the size of a pack of cigarettes; they are ruggedly constructed for heavy industrial use.

Such a system enables absolute compliance with all local, state or federal batching regulations. Formula privacy can also be indefinitely retained because operators need only know what Batchplug to use for a given batching order.

When the plant operator pushes a "start" button on the small control panel, an electrical signal channeled through the Batchplug starts flow of the first specified formula ingredient. After the desired amount of this ingredient flows into the weigh hopper (or through a check point for liquids blending), the device automatically stops material flow and starts to draw the second ingredient.

This operational sequence continues until all of the formula's ingredients have been measured in their respective preset amounts. At this point, the Batchplug empties the

## Life in these excited states...

weigh hopper (or blending reservoir), and the material passes to further processing, shipment or storage. Meanwhile, the control panel resets itself and starts a new cycle beginning again with ingredient number one.

Changeover from one formula to another requires removal of the Batchplug in use, and insertion of a new one. Operation of the control panel, including presetting of the plugs to any individual formula, requires no special skill or training. Accuracy can be held to within 0.1% in most cases.—  
The Howe Scale Co., Rutland, Vt.

180A



### Metering Pumps

Versatile line makes debut. Wide capacity range.

Called Masterline, a new series of metering pumps will soon form the backbone of Hills-McCanna's product line. According to company officials, all of the manufacturer's other metering pumps will now take on the characteristic of specialty items designed for specific and unusual customer requirements.

For standard duty, the new line—consisting of the Masterline 20, 30, 40 and 50—offers pumping capacities ranging from a fraction of a gallon per hour to 1,020 gph.

Competitively priced at \$300 to \$1,100, these pumps incorporate such features as: straight-through-flow check valve that minimizes turbulence and pressure drop; speed reducer separated from motor for easy replacement; new wear-reducing crank drive; interchangeability of parts; and attractive over-all appearance.

The company is now prepared



## Corrosion makes profits thin, too

If corrosion and contamination are eating into your profit margin, you need chemical-resistant equipment by American Hard Rubber Company. Look today to see where you can use Ace rubber and plastic pipe, valves, pumps, tanks and special parts. It doesn't cost...it pays!

Ace chemical-resistant rubber-lined steel pipe best for high-pressure, big sizes, or abrasives. Pipe, fittings and valves 1½ to 24".

### STRENGTH OF STEEL



### BIG GIANT OF ACID PUMPS



Highly efficient WE pump. Capacity to 360 gpm. Cast iron, fully protected by top quality, chemical resistant hard rubber lining.



Variety and quality to match any plastic piping. Rivclor PVC, Ace-ite rubber-plastic, Parian poly, Ace Saran, Tempron high temperature nitrile, hard rubber-lined steel.



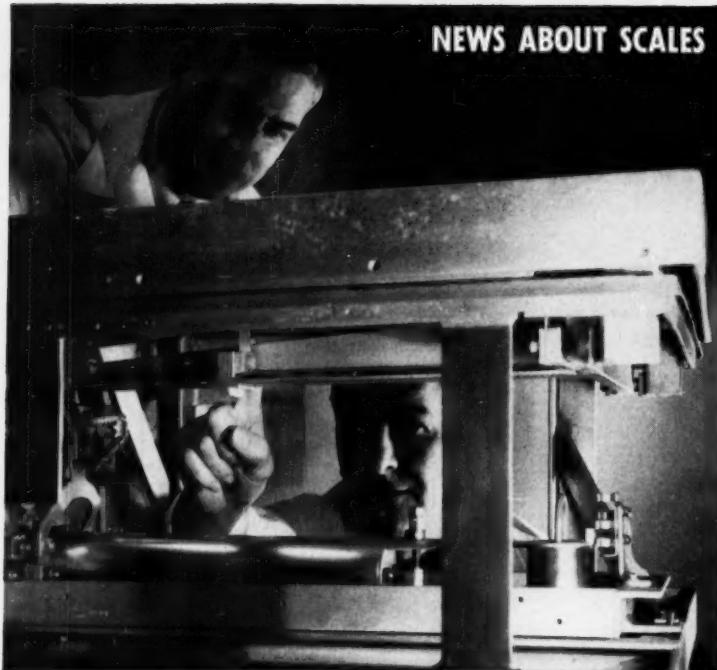
**ACE** processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY  
DIVISION OF AMERACE CORPORATION  
Ace Road • Butler, New Jersey



See our pages in  
**eee**  
Catalog!

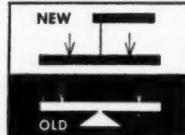
## NEWS ABOUT SCALES



### How do they build unvarying accuracy into this remarkable new kind of weighing instrument?

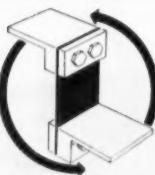
For 7,000 years men have employed the multi-part pivot balance to compare weights. As the parts of their pivot joints wore, the problem of retaining accuracy became more and more acute. Then in 1956 the United States issued a patent for a "Thayer Flexure Plate" Leverage System. A team of engineers and businessmen, aware of industry's great cumulative loss of materials in weighing operations, had devised a revolutionary new scale. Knife-edge pivots that progressively wear and change were replaced by Thayer Flexure Plates that move only .001", yet accurately reflect the minutest changes in weight. This firmly joined lever withstands

shocks and vibrations indefinitely. Dirt and dust are no longer a problem.



#### How Can It Save You Money Year After Year?

Working in conjunction with straight electrical controls, it forms the most reliable, low maintenance system ever devised to control processing or materials handling by weight. Literature on its application to filling, batching and checkweighing operations is available on request.



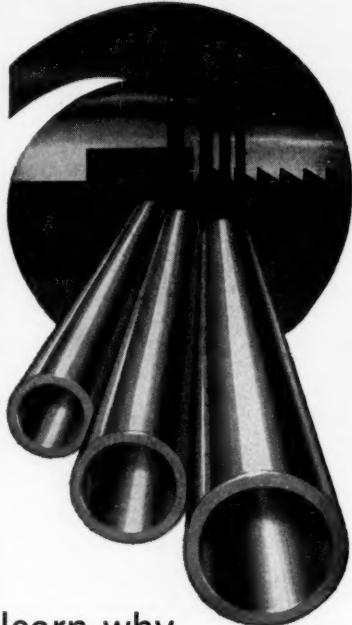
### THAYER SCALE

AUTOWEIGHTION SYSTEMS FOR FILLING,  
BATCHING AND CHECKWEIGHING

THAYER SCALE CORP. • 23 THAYER PARK, PEMBROKE, MASS.

## know the facts about annealing

before you specify  
stainless steel  
tubing for chemical  
applications!



### learn why

Standard's production specifications for stainless steel pipe and tubing demand annealing as one important step to assure you ductility and maximum resistance to corrosive agents... to guarantee you uniform structure by eliminating stresses... to provide you ease of fabrication and savings on original and replacement material costs. Engineers at Standard are specialists in the selection of the proper grade of stainless steel pipe and tubing for industry. They are anxious to work with you. For complete details call your local Standard representative or contact Standard.

## STANDARD

THE STANDARD TUBE COMPANY and  
MICHIGAN STEEL TUBE PRODUCTS DIVISION

24400 Plymouth Road • Detroit 39, Michigan  
Welded stainless tubing and pipe • Welded carbon  
steel mechanical • Boiler and Heat Exchanger • Exclusive  
rigidized patterns • Special Shapes • Steel Tubing  
—Sizes:  $\frac{1}{8}$ " OD to 6" OD—.028 to .270 wall • Stainless  
—Sizes:  $\frac{1}{8}$ " OD to 4 $\frac{1}{2}$ " OD—.020 to .187 wall

#### ... NEW EQUIPMENT

to ship on two weeks notice.—  
The Hills-McCanna Co., Chi-  
cago, Ill. 181A



#### Multiswitch Indicator

Null-balance unit checks  
temperatures.

For rapidly checking temperatures of many points, the Series 9000 multiswitch indicator offers accuracies of  $\pm \frac{1}{2}\%$  for all scale spans in the pyrometric range. Sensitivity is 5 microvolts for scale spans of 5 mv.; for wider spans it is  $\pm 0.1\%$ . Balance speeds are fast, with a choice of 2, 4 or 15 sec. Scale is 11 in. long.

Series 9000 indicators can be used for as many as 108 stations. The basic instrument is a completely self-contained, null-balance unit. External sensing devices are not included. — Barber-Colman Co., Rockford, Ill. 183A



#### Fractionation Tray

Utilizes new variable-ori-  
fice valve units.

Valve units on a new fractionation tray act as variable orifices that provide multistaging of slot area for different rates of vapor flow.

Design of the new ballast units establishes: (1) uniform

... higher meta content to give you more speed,  
lower unit cost in phenolic resin applications



PITT-CONSOL Meta Para Cresol offers 2.7 parts of meta to every one of para! That's more meta cresol (over 70%) than most mp cresols on the market ... and the big reason why it provides a faster cure in brake linings, varnishes, molding compounds and many other phenolic resin applications. Investigate the advantages of PITT-CONSOL Meta Para Cresol . . .

Available in 2° and 3° grades of high purity and closely controlled uniformity.

- For any cresylic acid with the quality and performance you seek look to Pitt-Consol first. Send for a brochure covering the complete line or consult our insert filed in Chemical Materials Catalog.

"Expanding cresylics to further industry"



**PITT-CONSOL**  
Chemical Company

191 DOREMUS AVE. • NEWARK 5, N.J.

A SUBSIDIARY OF CONSOLIDATION COAL COMPANY



**Drop Forged from  
Solid Billets...**

# FORGED STEEL FITTINGS



Heat . . . pressure . . . turbulence . . . oxidation . . . vibration . . . reduction . . . shock. For critical installation problems like these, get maximum protection with W-S Carbon, Stainless and Alloy Steel Fittings.

- Drop forged to produce exceptionally high tensile and impact strength.
- Long accurate threads, in perfect alignment, for ease of installation.
- Heavy uniform fitting wall thickness—an important safety factor.
- Accurate machining to fit tight.

For your next order, call your nearby W-S Distributor. You'll find him ready with comprehensive stocks of the complete line of W-S high-quality fittings. *Forge & Fittings Division, H. K. Porter Company, Inc., Box 95, Roselle, New Jersey.*

**FORGE AND PORTER FITTINGS DIVISION**  
**H.K. PORTER COMPANY, INC.**

**Divisions:** Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Mouldings, National Electric, Refractories, Riverside-Alloy Metal, Thermod, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

## NEW EQUIPMENT . . .

distribution of vapor through the liquid across the tray, (2) optimum vapor velocities, (3) turndown ratios of at least 9:1 and (4) a primary pressure drop at the vapor-liquid interface for maximum tray efficiency.

According to the manufacturer, the new ballast tray retains all good features of bubble-cap and perforated trays, while eliminating inherent problems encountered with ordinary valve-type trays.—Fritz W. Glitsch & Sons, Inc., Dallas, Tex.

183B

## Tube Expander Drives

Designed for fast, precision tube rolling.

Two new expander drives for  $\frac{1}{4}$  through 3-in. tubes feature permanent-magnet controls that disengage and stop rolling action when preset torque levels are reached.

Neither drive utilizes any springs, clutch, ratchets or friction-loaded parts—motor operation is smooth and continuous at 1,000 rpm.

Trigger-actuated motors are air operated. Operation is simple—the motor runs forward when the trigger is squeezed, and reverses when the trigger is released. Tools are unnecessary for torque setting.—Elliot Co., Springfield, Ohio.

184A

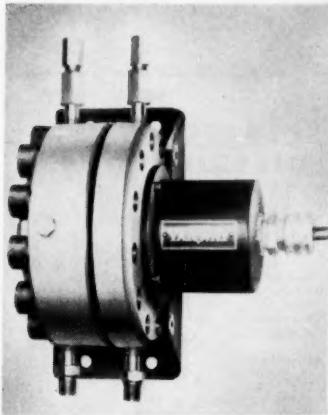
## Surge Control System

Increases safe output of large compressors.

With the new CompuDyne surge control system, large compressors, blowers and exhausters can be safely operated nearer to the surge point than previously possible. In addition, the system improves operating stability and reduces power consumption of these machines.

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plicable to units from 50 hp. up.  
—CDC Control Services, Inc.,  
Hatboro, Pa. 184B



#### Transmitter

For electrically controlled instrumentation.

Dependability, fast response, simple installation and broad range adjustment are some of the features claimed for the new Yarway differential-pressure transmitter. The instrument consists of a diaphragm mechanism in a pressure housing equipped with two tubular pressure connections, and a sensing coil. Variation in differential pressure applied to the diaphragm changes the electrical output of the coil.—Yar-  
nall-Waring Co., Philadelphia,  
Pa. 185A

#### BRIEFS

**Turbocharged compressor** package for field use includes gas-engine driven compressor, radiator, scrubbers and other accessories mounted on a steel skid. Rating is given as 525 bhp.—Clark Bros., Olean, N. Y. 185B

**Cyclone separator** for 4,000- to 6,000-cfm. range separated 99% sawdust, 99.2% steel grindings and 94% flour in laboratory tests.—Torit Mfg. Co., St. Paul, Minn. 185C

**Centrifugal compressor** raises pressure of 2,000 cfm. oxygen

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the new

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### NEW EQUIPMENT . . .

from atmospheric to 120 psia. Directly connected to a 750-hp. steam turbine, the new compressor features stainless steel casing and water-lubricated journal bearings.—Elliott Co., Jeannette, Pa. 185D

Filter tubes made of siliconized glass fabric reduce pressure drop and increase air-to-cloth ratio. Manufacturer claims that the new Filter Flex bags can cut space requirements in half.—Coast Mfg. & Supply Co., Livermore, Calif. 186A

Lift truck of 3,000-lb. capacity is offered in either gasoline or LP fuel models. Two transmissions are available: standard or Power-Shift Torque Converter Drive. — Allis-Chalmers Mfg. Co., Milwaukee, Wis. 186B

### Equipment Cost Indexes . . .

Industry	Sept. 1958	Dec. 1958
Avg. of all . . . . .	230.9	231.3
Process Industries		
Cement mfg. . . . .	223.3	223.7
Chemical . . . . .	232.3	232.7
Clay products . . . . .	217.0	217.4
Glass mfg. . . . .	219.3	219.7
Paint mfg. . . . .	222.8	223.1
Paper mfg. . . . .	223.8	224.2
Petroleum ind. . . . .	227.5	227.8
Rubber ind. . . . .	230.3	230.6
Process ind. avg. . . . .	228.6	228.8

### Related Industries

Elec. power equip. . . . .	236.0	236.4
Mining, milling . . . . .	233.7	234.1
Refrigerating . . . . .	260.3	260.6
Steam power . . . . .	218.1	218.4

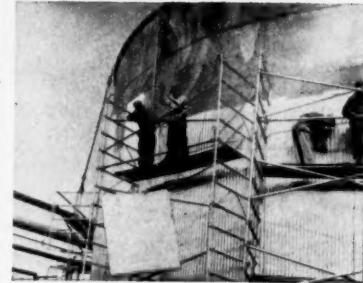
Compiled quarterly by Marshall and Stevens, Inc. of Ill., Chicago, for 47 different industries. See Chem. Eng., Nov. 1947, pp. 124-6 for method of obtaining index numbers; Feb. 23, 1959, pp. 149-50 for annual averages since 1913.

### For More Information . . .

about any item in this department, circle its code number on the

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postcard (p. 201)



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## TECHNICAL

### First Integrated Coverage

BIOCHEMICAL ENGINEERING. Edited by Robert Steel. Macmillan Co., New York. 328 pages. \$7.50.

Reviewed by E. L. Gaden, Department of Chemical Engineering, Columbia University, New York.

Perhaps the most expressive thing that can be said about the volume "Biochemical Engineering" is simply that it exists. For over ten years the term "biochemical engineering" has been bandied about—mostly on editorial pages—and this is the first book which attempts any kind of integrated coverage.

"Biochemical Engineering" is neither a poor book nor an outstanding one. In fact its origins herald its strength and weakness. The editor, Dr. Robert Steel, now of the Upjohn Co., has put together a series of lectures given at the Manchester College of Science and Technology in 1957 where he was then in residence. The book suffers from the universal vice of such compilations: coverage is according to the interests and inclinations of the individual lecturers. On the other hand something has at least been gotten down on paper—more than any individual author has been able to accomplish so far.

In England the phrase "biochemical engineering" seems to be a little better accepted than here. Evidently it is used to cover, more or less loosely, what we would call "fermentation technology" plus product recovery. This is a perfectly legitimate usage—and one which might well be used here if earlier protagonists had not argued so strongly for a separate "discipline."

The individual chapters cover, after a couple of introductory treatments of "history and scope," the following subjects: Chemical activities of micro-organisms; substrates for fermentation processes; sterilization; the development of a

## BOOKSHELF

J. B. BACON

typical anaerobic process (acetone-butanol), and an aerobic process (penicillin); aeration and oxygen supply; equipment design; product recovery. A final section discusses "basic economics" and the future possibilities for fermentation technology.

The individual contributions are generally well done and, though many points of interest remain untouched, the book has an air of competence and basic completeness. By and large the important points are stressed and details are not belabored.

While "Biochemical Engineering" is neither an ideal textbook (if, indeed, such a creation is possible) nor a comprehensive reference, it is still a significant addition to the worthwhile literature of "applied microbiology."

### BRIEFLY NOTED

**DIRECTORY OF MANUFACTURERS' REPRESENTATIVES, 1959.** 203 pp. Manufacturers' Agent Publishing Co., 505 Fifth Avenue, New York 17, N. Y. \$20. Lists more than 15,000 manufacturers' domestic and export representatives in the U. S., its Territories and Canada.

**SIMPLIFIED TECHNIQUE OF CONTROL-SYSTEM ENGINEERING.** 303 pp. By George K. Tucker and Doris M. Wills. Brown Instruments Div., Mail Station 0-280, Minneapolis Honeywell Regulator Co., Wayne & Windrim Aves., Philadelphia 44, Pa. \$5. Contains non-mathematical approach to understanding process control and a graphic method for dynamic analysis of industrial instrumentation systems, includes selected bibliography.

**REFRIGERATION TERMS AND DEFINITIONS** — American Standard B53.1-1958. 33 pp. American Standards Assn., Dept. PR43, 70 E. 45 St., New York 17, N. Y. or American Society of Refrigerating Engineers, 234 Fifth Ave., New York 1, N. Y. \$1.25. Provides definitions of words and terms used in refrigeration and air conditioning.



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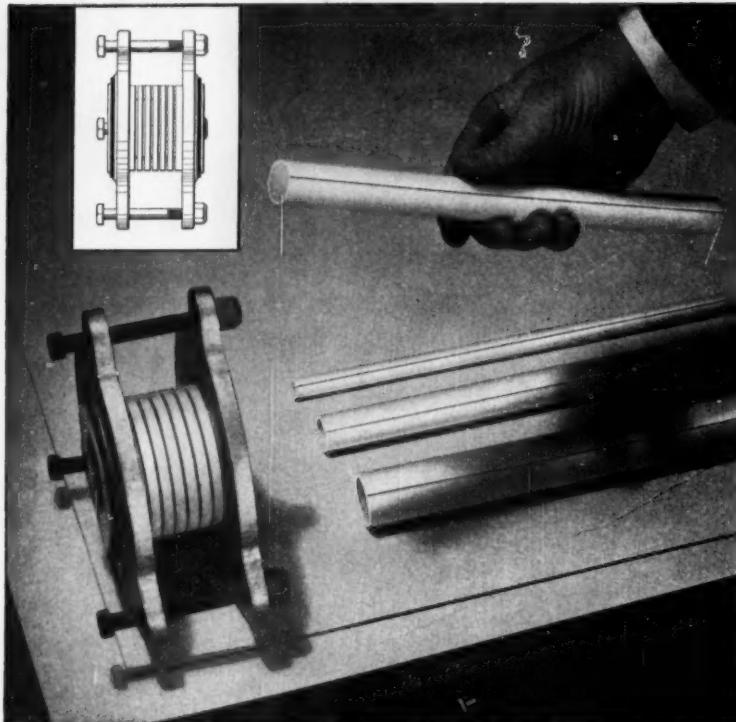
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**STOKES**

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- New expansion joint
- Color-striped thin-wall tubing
- Larger sheet sizes



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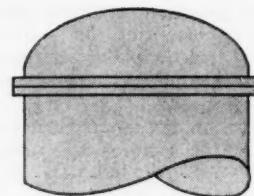
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## LETTERS:

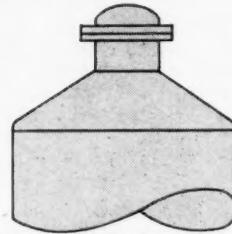


This...

### Pro: Hole in the Head

Sir:

The prize-winning idea in your February 9 Process Design Notebook (p. 130) was most interesting to us.



...or this...

At first glance it appears that Mr. Klengen is trying to show that a vessel with a conical head is cheaper than a vessel with a conventional dished head. Upon closer reading of the article, I find that the cost differential is actually due to replacement of the 6-ft., 6-in. flanged opening by a 2-ft. flanged opening.



...or this?

We would favor a third alternative, namely, a welded-on 6-ft., 6-in. dished head fitted with a 2-ft. flanged opening. Our cost analysis shows that this construction would cost no more than Mr. Klengen's design, and if pressure be any consideration

## PRO & CON

C. H. CHILTON

the cost differential would further favor our alternative.

D. E. KROPP

Pfaudler Co.  
Elyria, Ohio

*Sir:*

I was very much interested in Mr. Klengen's article, particularly in the apparent differences in American and Netherlands rules for construction of unfired pressure vessels.

Mr. Klengen has stated that the 6-ft., 6-in.-dia. vessel, designed to operate at 100 psig., requires a wall thickness of  $\frac{1}{8}$  in. Under ASME rules (which employ a factor of safety of 4), this thickness could be reduced, even if the joints were not x-rayed. In fact, a corrosion allowance of  $\frac{1}{8}$  in. could be taken and still keep the thickness under  $\frac{1}{8}$  in., assuming that steel plate corresponds to ASTM A-285(C).

Costs could be further cut by reducing the 24-in. opening to 16 in., which is ASME standard for a circular manway opening.

JAMES G. DAVIS  
Cleveland, Ohio

*Sir:*

It is of minor importance to my main idea whether we use a dished head or a conical head. The big point is omitting the 6-ft., 6-in. flanges.

I intentionally compared the flanged-and-bolted dished head with a welded-on conical head in order to attract attention to the article. I even penalized the conical head with a higher unit cost (36¢/lb. for conical vs. 25¢/lb. for dished), and still came out with a favorable cost differential.

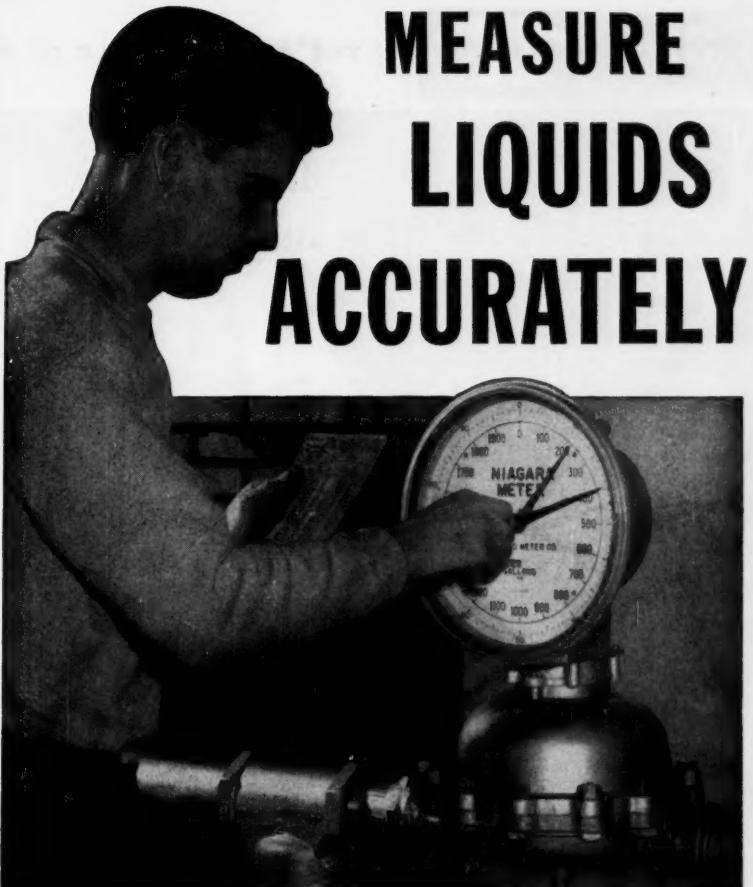
J. KLENGEN  
The Hague, Holland

### Who Is a "Professional"?

*Sir:*

I was somewhat surprised at the intermingling of fact and opinion in your report of the AIChE panel discussion on professional development (Jan. 26, 1959, p. 128).

If you had confined your re-



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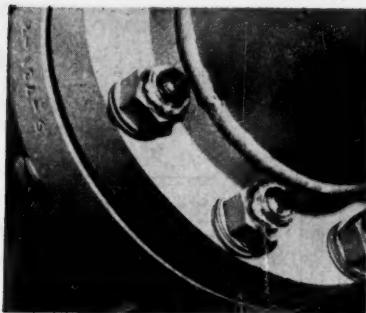
needed to effect a permanent hermetic seal. And it is chemically inert! Thus, corrosive materials in the capacitor won't affect the seal even when they are hot or carrying large electrical loads. (KEL-F Elastomer exhibits excellent electrical properties, too.) What's more, the seal won't oxidize at high temperatures!

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## PRO & CON . . .

port to the Sunday afternoon session of the Cincinnati meeting, one could not argue with your relatively incomplete coverage of the problem of engineering registration. However, the last four or five paragraphs represent editorializing on your part and would seem to justify a more thoughtful approach to this admittedly complicated area.

In regard to licensing, one must consider both the practical and the professional problems. From a practical standpoint every state has some type of engineering license law. In general, these laws restrict engineering practice by unregistered individuals in areas other than industrial concerns. Therefore, from a practical standpoint, all engineers who are not exempted by these laws have a vital interest in registration.

Further, those who currently are exempted must have an interest if they wish to maintain freedom to pursue their profession in nonexempted areas at a future time. In this frame of reference, it is not important as to whether one is for or against engineering registration.

From a professional standpoint, you omitted from your article the fact that ASME, AIEE and ASCE all have gone on record as indicating that they believe engineering registration to be in the best interests of the engineering profession.

F. E. REESE

Wilbraham, Mass.

► *We agree with Mr. Reese as to the legal and practical aspects of engineering registration. Licensing of engineers for public practice serves a definite, useful function, as does licensing of physicians, pharmacists, electricians and barbers. A man can cut his own children's hair at home without a barber's license, and a man can practice engineering privately without registration. It is privately when the barber or engineer deals with the public that licensing enters the picture.*

*However, we disagree with Mr. Reese as to the "professional" aspects of engineering registration. But the columns of this department do not provide a suitable forum for debate of what Mr. Reese aptly terms a "complicated area." Suffice to say that a number of AIChE Council members agree with the opinions expressed in our report of the Cincinnati meeting.—ED.*



## NEWS NOTES from McGRAW-HILL

With real pleasure McGraw-Hill announces to readers concerned with the chemical, mathematical, and related fields that five outstanding books may now be procured through its facilities. The books (formerly published by Handbook Publishers, Inc., Sandusky, Ohio) are accurate and comprehensive reference works that have achieved high regard among technical readers. The books are:

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### PRESSURE-VOLUME-TEMPERATURE RELATIONSHIPS OF ORGANIC COMPOUNDS

Accurate data on vapor pressure temperature and latent heat of vaporization useful in the laboratory or manufacturing plant. Tables apply to 23 families, thus covering almost all types of organic compounds—aliphatic and aromatic hydrocarbons, alcohols, acids, esters, ethers, amines, etc. By R. R. Dreibach, Dow Chem. Co. Third Ed., 315 pp., 11 x 8 1/2, \$10.00

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A handy summary of theory, working rules, and tabular material useful in practical problems in probability and statistics. Contains essential formulas and definitions, plus tables of distribution and other quantities of frequent use in statistical work. By R. S. Burington, Bureau of Ordnance, Navy Dept., and D. C. May, Jr. 342 pp., \$6.00

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# ELLIOTT air magnetic tube expander drives

*automatically controlled  
for fast, accurate tube rolling*



STANDARD  
MODEL



for HEAVY-  
DUTY JOBS

Designed for faster, precision tube rolling, the standard model Elliott Air-Magnetic drive is setting new records for speed and accuracy. Some operators average 12 tubes per minute. Desired torque easily preset by rotating forward end of unit. No tools needed. Rolling stops when preset torque levels are reached. Includes trigger-controlled, explosion-proof air motor in single unit. Magnetic control, no springs. Balanced for easy handling. For tubes  $\frac{1}{4}$  in. through 3 in. Standard model handles most jobs. Heavy-duty for higher torque.

## ALSO Electric Control ... Tube Expanders...

### and Related Accessories

Elliott offers the Automatic Electric Control—an accurate torque-limiting device designed for tube expanding with any standard tapping motor. Also, a complete line of tube expanders, with rotating, parallel, self-feeding rolls. Available in 4 sizes, ranging from  $\frac{1}{4}$  in. to  $3\frac{1}{2}$  in. O.D.

Other related accessories include Elliott tube gage, tube plugs, tube pilot, and tube rolling lubricant.

Write for descriptive literature today.



VS-3



**ELLIOTT Company**

LAGONDA PLANT, Springfield, Ohio

## READER SERVICE . . .

# TECHNICAL

### Contents of This Issue

Chemicals & materials . . .	194
Construction materials . . .	196
Electrical & Mechanical equipment . . .	198
Handling & Packaging . . .	200
Heating & Cooling . . .	204
Instruments & Controls . . .	206
Pipe, fittings, valves . . .	208
Mechanical equipment . . .	198
Process equipment . . .	212
Pumps, blowers, compressors . . .	218
Services & processes . . .	220

### Chemicals

**Butyl Rubber** . . . is the ideal material for wire & power cable, transformers, tapes, busbars & other insulation applications. Resists weather, chemicals, etc. Data 91 \*Enjay Company, Inc.

**Calcium Hydrides** . . . dry materials completely in gas or liquid phase. Details on complete drying with calcium hydride are contained in a new bulletin.

97 \*Metal Hydrides Inc.

**Carbon Dioxide** . . . CO<sub>2</sub> is a low-cost inert gas with a wide range of applications such as blanketing explosives & combustibles, etc. & shielding welding arcs.

228 \*Olin Mathieson Chem. Corp.

**Chemicals** . . . A complete list of patents on the use of Hydrogen Peroxide, Peroxygen Chemicals and Persulfate Chemicals is now available on your request.

47b \*Becco Chemical Div., FMC

**Chemicals** . . . A new General Products list has 12 pages of quick references to all chemicals & services. Other bulletins are also available.

Bul. 100-B. 234a \*Hooker Chemical Corp.

**Chemicals** . . . for cleaning process equipment without dismantling, by in-place chemical circulation, using specialized materials & methods. Technical Bulletin.

229 \*Oakite Products, Inc.

**Cold Caustic Bleach Process** . . . allows you to bleach in the same equipment regularly used for the mfg. of cold caustic pulp. Complete information on Process is available.

47a \*Becco Chemical Div., FMC

**Elastomer** . . . Kel-F elastomer is chemically inert. Exhibits excellent electrical properties. All the facts about Kel-F elastomer performance characteristics offered.

192 \*Minnesota Mining & Mfg. Co.

\* From advertisement, this issue

## LITERATURE

E. M. FLYNN

**Ethylene Amines** . . . "Ethylene Amines," a 65-p. publication, provides comprehensive coverage of ethylene amine chemistry: properties, uses, reactions, handling. 195A Dow Chemical Co.

**Fluorocarbon Resins** . . . TFE resins are rated for continuous use at 500 F. A new booklet "How to Use Sheets, Rods, Tubes, Tape and Other Standard Shapes of Teflon" offered. 147 E. I. du Pont de Nemours & Co.

**Fluorocarbon Resin Products** . . . Polypenco Teflon rod, tubing, sheet & tape available in sizes to meet requirements. Tech. information & purchase specifications offered. 151 The Polymer Corp. of Penna.

**Meta Para Cresol** . . . available in 2 & 3 degree grades of high purity & closely controlled uniformity. Applications in brake linings, varnishes, etc. Brochure. 183 \*Pitt-Consol Chemical Co.

**Pigment** . . . 8 p. booklet describes new basic lead silico chromate and its physical properties which suit it for formulation of primers, intermediate and finish coats. 195B Eagle-Picher Co.

**Plastic** . . . Bulletin on Plastic Steel is now available. Easy to use as modeling clay . . . hardens to steel like strength in 2 hours . . . can be machined with regular tools. L197 \*Devcon Corp.

**Plasticizers** . . . Versatility of solid plasticizers in adhesives, lacquers, foams, films and rigid plastic compositions is detailed in a new booklet. Specs for 14 plasticizers. 195C Monsanto Chemical Co.

**Plastics** . . . New teflon expansion joint, Teflon thin-wall tubing & Teflon sheet in 36 x 36 inch sizes is now available. Literature is offered. 190 \*Raybestos-Manhattan, Inc.

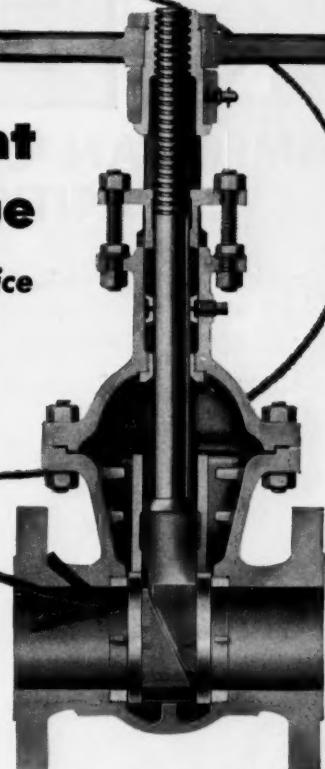
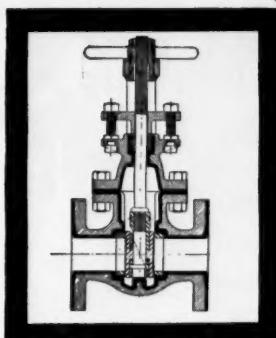
**Plastics** . . . Teflon Sheet is heat resistant (550 F), chemically inert, it's non-adhesive & easy to use. Available in widths up to 48 inches by any length you want. 172 \*W. S. Shamban & Co.

\* From advertisement, this issue

Want to build up your files and keep them up-to-date? You can get any publication in this comprehensive guide — free — just for the asking.

It's easy — simply circle item's number on the Reader Service Postcard and mail. Replies will come directly from companies offering the literature.

## Important plus-value for corrosive service gate valves



Darling rubber-lined gate valves with special alloy working parts (left) are made for pressures to 150 pounds and temperatures to 150°. Other Darling gate valves come in a wide range of sizes, types and constructions for all normal and unusual services.

**S**URE Darling gate valves are available in the metals or special alloys needed for your particular service . . . and you ought to look into the hard rubber lined iron body type for possible savings. But beyond all that is where the real *plus-value* begins—the result of Darling's fully revolving double disc parallel seat principle!

This principle assures uniform wear distribution, automatic seating compensation, and avoidance of disc-to-seat galling. It means prolonged tight closure, much less maintenance and far less chance of process interruptions!

It's easy to get *all* the facts on Darling plus-values. Just ask for new Catalog No. 57.

**ENGINEERING SERVICE:** Darling offers unusual facilities for the development and manufacture of special valves for out-of-the-ordinary requirements. This special service is available to you at all times, without obligation.



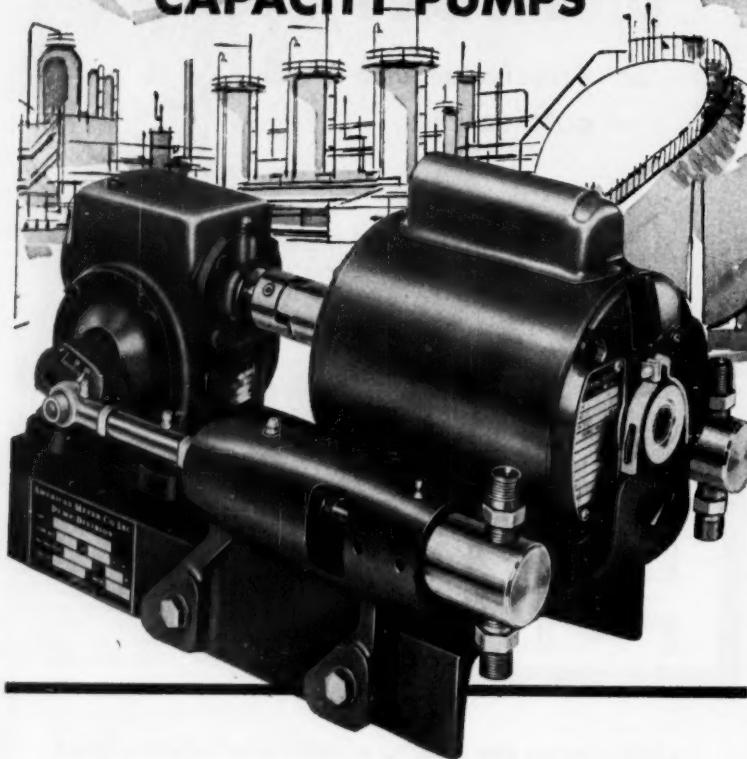
### DARLING VALVE & MANUFACTURING CO.

Williamsport 3, Pa.

Manufactured in Canada by  
Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

# NEW

## AMERICAN CONTROLLED CAPACITY PUMPS



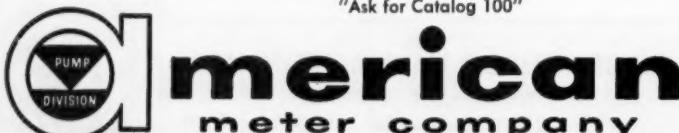
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New American controlled capacity pumps are precision built to meet the needs of Chemical Processing, Refining and Boiler Feed applications. Quality construction assures highest accuracy in feeding precisely metered fluids or slurries into low or high pressure systems in virtually all desired ratios, with flow, temperature, pressure, conductivity, PH and other controlled process variables. Control may be manual or automatic—with electric, hydraulic or pneumatic systems.

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"Ask for Catalog 100"



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### LITERATURE . . .

**Polyethylene**.....Epolene C and Epolene N, non-emulsifiable low-molecular-weight polyethylene resins, are described in a 22 p. booklet. Emphasizes paper coating application.

73 \*Allied Chem., Gen. Chem. Div.

**Polyvinyl Chloride**.....an exceptionally versatile industrial plastic with outstanding resistance to 281 corrosive solutions & gases. PVC Bulletin 80-3 offered.

126 \*Joseph T. Ryerson & Son, Inc.

**Salicylaldehyde**.....Bulletin gives physical properties, reactions, uses, toxicology of this chemical intermediate used in perfumes, soaps, deodorants, reagents.

196B Dow Chemical Co.

**Sodium**.....Brochures, "Handling Metallic Sodium on a Plant Scale," "High Surface Sodium" and "Sodium Dispersions" are now available on request.

125 \*U. S. Industrial Chem. Co.

**Sulfuric Acid**.....Information offered on service & facilities for sulfuric acid users with problems of handling & disposal of large quantities of sulfuric waste materials.

73 \*Allied Chem., Gen. Chem. Div.

**Surfactants**.....24 p. catalog of anionic, cationic and non-ionic agents are described by trade name, active ingredient, % activity, physical state, use, properties.

196C Onyx Oil & Chemical Co.

**Vinyl**.....Spiral bound, 26 p., "Insular Vinyl Polymers & Copolymers," includes technical specification sheets and application recommendations.

196D Rubber Corp. of America

**Wire Cloth**.....A 94-page catalog & stock list gives the full range of wire cloth available, describes fabrication facilities & gives useful metallurgical data.

40 \*Cambridge Wire Cloth Co.

### Construction Materials

**Alloy**.....The new booklet "Introduction to Ni-o-nel" describes composition, physical & chemical properties, plus suggested applications for Ni-o-nel nickel-chromium alloy.

52 \*The International Nickel Co., Inc.

**Alloys**.....Full information on corrosion-resistant alloys, their properties, forms, the corrosive they will resist, contained in a 104-page book. Send for your copy.

163 \*Haynes Stellite Co.

**Coatings, Protective**.....Niphos is a corrosion-resistant protective coating for all mild steel. The advantages & applications of Niphos are outlined in a brochure.

196E Tube Reducing Corp.

**Hydrated Chromium Oxides**.....are most stable of the green pigments. They are unaffected by acids, alkalis, vehicles, & solvents. Full technical data & samples offered.

170 \*C. K. Williams & Co.

**Insulation**.....Ultralite is made exclusively of long, strong, textile-type glass fibers. Available in rolls up to 10' in width & in thicknesses up to 6". Information.

187 \*Gustin-Bacon Mfg. Co.

\* From advertisement, this issue



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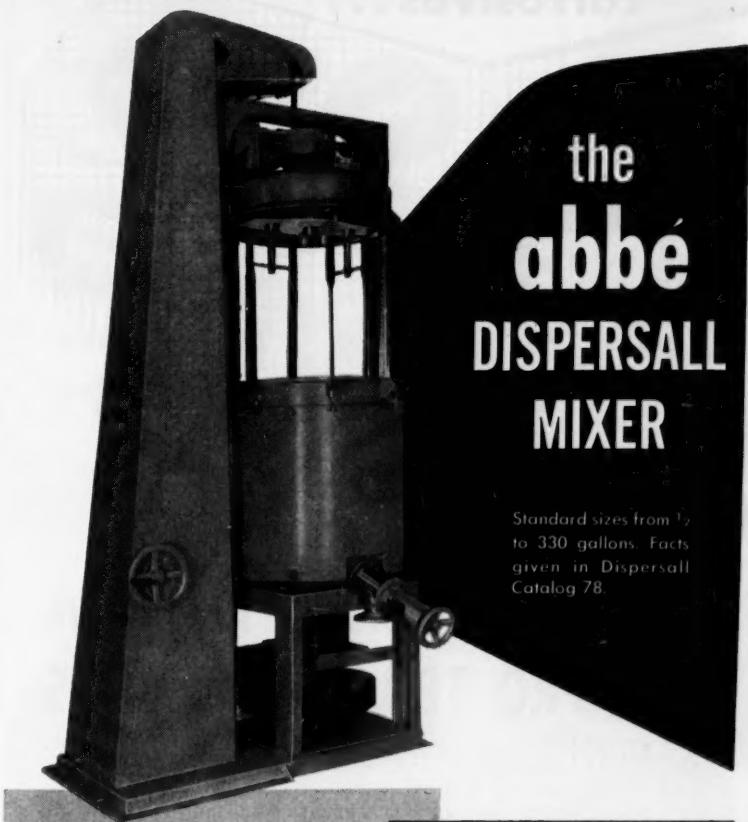
Find out how PLASTIC STEEL® and other Devcon products can save time, cut maintenance costs and speed production in your plant — write for FREE bulletin today.

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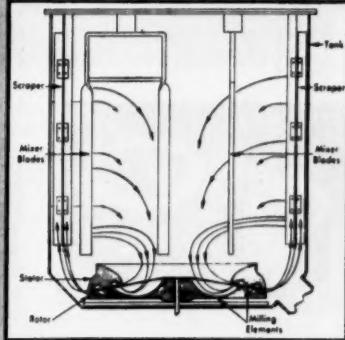
# LIQUIDS, SLURRIES, PASTES



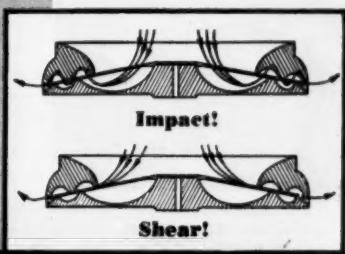
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Standard sizes from  $\frac{1}{2}$  to 330 gallons. Facts given in Dispersall Catalog 78.

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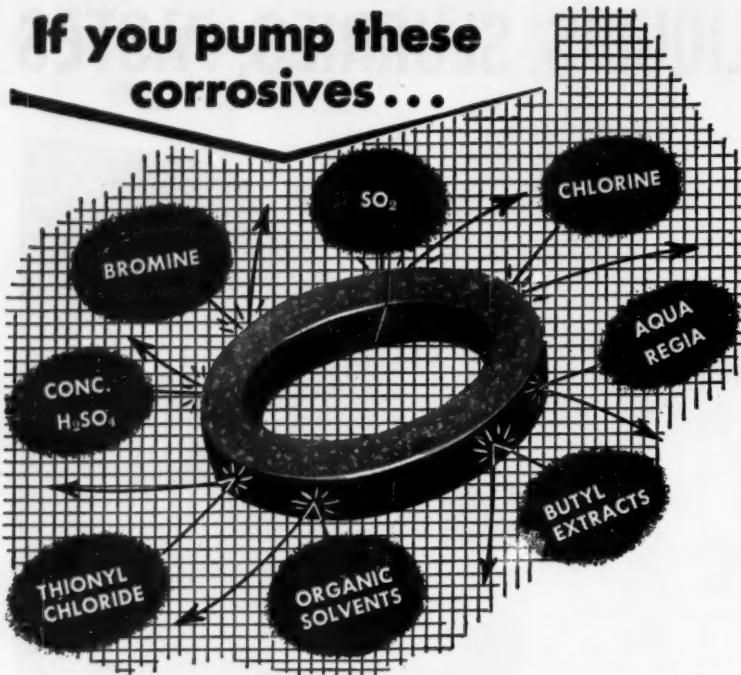
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## Get months of Trouble-Free service with **CHEMPRO TEFON PACKINGS**

If your pumps and valves handle highly corrosive industrial chemicals, CHEMPRO TEFON PACKINGS will drastically cut packing replacement and maintenance costs. CHEMPRO Packings last for many months under corrosive conditions which make ordinary packings useless in days or even hours. They stop leakage by providing a tight seal at only slight gland pressure, and their very low coefficient of friction often makes lubrication unnecessary.

### TEFLON\* PLASTIC STUFFING BOX PACKING

Ideal for either centrifugal or reciprocating pumps operating at speeds up to 3600 R.P.M. handling corrosives at temperatures from -118° F. to 525° F. Style No. 101 composed of 94% shredded Teflon and chemically inert graphite as a friction reducer. Style No. 201 same as No. 101 except that mica is used as friction reducer. Both styles made to fit every size stuffing box on standard process equipment.

### TEFLON V-TYPE PACKINGS

For reciprocating pumps and hand, air and motor operated valves handling corrosive materials. Lips of very sensitive pressure rings expand proportionately to increased operating pressure thereby preventing leakage. Suitable for temperatures from -150° F. to 550° F. Unsuitable for centrifugal or rotary pumps. Supplied in bulk or in complete sets to fit specific stuffing boxes.



Chemical & Power Products engineers are packing and gasket specialists with complete fabricating facilities to meet your specific requirements. Write for our complete Teflon Packing and Gasket Catalog.

\*du Pont Trademark

## **CHEMICAL & POWER PRODUCTS, INC.**

The Original Fabricators of Teflon Packings and Gaskets



5 BROADWAY, NEW YORK 4, N. Y.

### LITERATURE . . .

**Metal, Corrosive-Resistant**..... Horton-clad is produced through a patented continuous bonding process. Hortonclad bulletin outlines structures for corrosive materials. Cover 198 \*Chicago Bridge & Iron Co.

**Packings**..... Teflon Packings last for many months under corrosive conditions. They stop leakage by providing tight seal. Teflon Packing & Gasket catalog offered. 198 \*Chemical & Power Prod., Inc.

**Packings, Tower**..... Resists high temperatures, fumes, vapors, corrosion, liquids, alkalies & acids. Complete information, prices & samples available on request. BR217 \*Knox Porcelain Corp.

**Stainless Steel**..... A complete selection of literature is available on different sizes, shapes & finishes. Publication list describes over 150 technical pieces. 60 \*Allegheny Ludlum Corp.

**Stainless Steel**..... Information on all services in stainless steel are available on request. Included are plate, plate products, heads, rings, etc. Send for your copy. 39 \*G. O. Carlson, Inc.

**Stainless Steel Tubing**..... Annealing is one important step to assure you ductility & maximum resistance to corrosive agents. Complete details on selection of materials. R182 \*The Standard Tube Co.

**Tantalum**..... "Corrosionomics", a journal of useful information for the solution of corrosion problems. Technical data on Tantalum, its uses & properties. 218 \*Fansteel Metallurgical Corp.

**Titanium**..... Intended as a reference for engineers wanting the latest information on titanium, booklet discusses production, machining, applications and data. 198A Harvey Aluminum

**Vacuum Retorts**..... used for high-temperature vacuum annealing. Facilities & skills cover a wide range of tanks, furnace retorts, tanks & other fabrications. TR213 \*Rolock Inc.

### Electrical & Mechanical

**Automatic Reflux Head**..... Explosion proof, electrically operated for high vacuum, pressure & temperature & for corrosive & hazardous service. Information available. 200b \*Distillation Engineering Co.

**Automatic Reflux Splitter**..... Available as standard units with capacities up to 3000 gals. per hour. Larger & steam-jacket units also. Complete information offered. 200c \*Distillation Engineering Co.

**Drive, Screw Conveyor**..... a complete package drive with quick-removable Driving Shaft. Available from stock with 5 different size shafts. Technical data in bulletin. 168 \*Dodge Mfg. Corp.

**Drives**..... Air magnetic tube expander drives and also electric control tube expanders and related accessories are covered in descriptive literature. 194 \*Elliot Co.

\* From advertisement, this issue

# Will this \$30,000 AUTOMATIC PALLETIZER save you money?



The Miller Palletizer automatically positions bags in proper pattern on the roller table. A completed pattern then moves across the rollers to an elevator, which descends one position as each layer is added. At full load position, the stack and pallet move automatically from the elevator for pick-up by a fork truck.

**IF** your plant is operating around the clock (7 days per week, 24 hours per day), and —

**IF** bag or box stacking is a part of that operation —

the **MILLER AUTOMATIC PALLETIZER** is almost certain to save you money. This completely automatic, operatorless unit is specifically engineered to slash production costs in two- and three-shift plants.

Just compare the cost of your present stacking operation with that of a Miller Automatic Palletizer (price: around \$30,000).

While you're thinking about it, write for bulletin describing operation of the Miller Automatic Palletizer in detail!

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To help solve your fluid and gas control problems, the broad line of Allis-Chalmers butterfly valves gives you:

**Uniform Control In All Positions** — You get consistent flow control through all positions in the normal regulating range. The flow curve within the broad control range is a straight line semi-log characteristic. Cam driven positioners can furnish other characteristics.

**Fast Regulation and Closure** — Speed of regulation and closing can be as fast as 1/10 second, or as long as system conditions require!

**Minimum Pressure Drop Saves Power** — In open position, the streamlined vane simulates Venturi action. Pressure drop is less than in many other valve types, helping to hold down your pumping costs.

**Compact, Light Weight** — Compact design and light weight permit more concise, space-saving layouts, cut construction and in-place costs.

For further information on Rotovalves, and butterfly, wafer and ball valves, contact your nearest A-C valve representative, or write Allis-Chalmers, Hydraulic Division, York, Penna.

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1

**LARGE SIZE REDISTRIBUTOR:** (now built in sizes up to 90") Collects and distributes liquid evenly over the packing, minimizes channeling and keeps packing wet and at maximum efficiency at all liquid rates. Especially suitable for vacuum distillation. Can be used with all types of packing and readily installed in any installation.

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**AUTOMATIC REFLUX HEAD:** Explosion proof, electrically operated for high vacuum, pressure and temperature and for corrosive and hazardous service. Designed to handle both vapor and reflux at the top of distillation columns. Eliminate reflux control problems with its simple, accurate and dependable operation.

3

**AUTOMATIC REFLUX SPLITTER:** Similar to item #2 but designed for handling reflux only. Available as standard units with capacities up to 3000 gals. per hour. Larger and steam-jacketed units also available. The above items are available in most materials of construction and in sizes 2" and larger.

FURTHER INFORMATION AVAILABLE ON REQUEST All items above are patented.

ALSO AVAILABLE: Packing support plates, distributor plates, stills, columns, and complete distillation plants.

# DISTILLATION

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COMPANY

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### LITERATURE . . .

**Drives & Couplings . . .** Bulletins on Dyna-V drives selection data, Paraflex couplings data and Flexidyne drives & couplings are available on request.

169 \*Dodge Mfg. Corp.

**Gearmotors . . .** Catalogs, price lists & selection tables of gearmotor speed reducers is available. In horizontal or vertical drive, 37 sizes. Send for your copy.

L215a \*D. O. James Gear Mfg. Co.

**Lighting Fixtures . . .** "AA-51" series vented explosion-proof lighting fixtures feature a new anti-vibration guard which protects against spark caused mishaps. Details.

68 \*Appleton Electric Co.

**Motoreducers . . .** Catalog, price lists & selection tables of motoreducers are now available. Type MS inline motoreducer offers ratio 9.2:1 to 1200:1.

L215b \*D. O. James Gear Mfg. Co.

**Motors . . .** New 1959 Motor Application Guide makes motor selection easy. Nine major factors in motor selection are described in detail. Covers manufacturer's line.

200A \*Century Electric Co.

**Motors . . .** that will not corrode. Complete information on 1 to 125 hp corrosion-proof motors is contained in Bulletin B-2406 which is now available.

235 \*Reliance Electric & Engr. Co.

**Motors Air . . .** A new bulletin describes 12 models of the manufacturer's line of Pistonair air motors. Designed for heavy-duty, motors range from 11½ to 20 hp.

200B \*Joy Mfg. Co.

**Piston . . .** Type 470 P.O.P. delivers same power in either direction at any point of the stroke. Adaptable to all types of valve bodies incl. butterfly valves. Bul. E-59.

18-19 \*Fisher Governor Co.

**Redistributor . . .** now built in sizes up to 90". Can be used with all types of packing & readily installed in any installation. Further information available.

200a \*Distillation Engineering Co.

**Thermocouple Assemblies . . .** A complete range of assemblies including; thermocouples, connection heads and thermowells. Features simplified ordering. Catalog.

R171 \*Thermo Electric Co., Inc.

### Handling & Packaging

**Air Hoists . . .** with capacities of  $\frac{1}{4}$  to 1 ton . . . hook or trolley models . . . roller or link chain . . . pendant or pull cable control. Information in Brochure #5145.

93 \*The Yale & Towne Mfg. Co.

**Elevator, Vertical Screw . . .** The Rotor-Lift elevates & conveys bulk chemicals. Handles capacities up to 6,000 cu. ft. per hr. Engineering catalog is available.

R168 \*Southwestern Supply & Mach.

**Feeder, Vibrating . . .** Amplitrol feeders increase vibrating stroke automatically when headload is increased. Also feature full range control. New 12-page bulletin.

212 \*Carrier Conveyor Corp.

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6	26-27	49a	66b	95a	102D	117	170	177h	186A	196C	205b	210	L217d	229
7	28-29a	49b	66c	95b	103	122	L171a	L178	186B	196D	205c	210A	L217e	230
8-9	28-29b	49c	68	95c	104A	123	L171b	R178	184	196E	205d	211	L217f	L231
10-11	28-29c	49d	73	96A	104B	124	L171c	179	185	L197	205e	212	L217g	TR231
12-13a	32	50	75	96B	104C	125	R171	180a	L186	R197	205f	212A	217h	TR231
12-13b	33	51	79a	96C	104D	126	172	180b	187	198	205g	L213	TR231	232
12-13c	34	52	79b	97	105	145	L173	180A	188	198A	205h	TR213	88217	L233
12-13d	35	53	79c	98A	106	147	R173	181	189	L199	205i	BB213	218	TR233
14-15	36	54	79d	98B	107-108	149	174	181A	190	R199	205j	214	218A	BB233
16-17a	37	55	79e	98C	109	151	L173	L182	191	206a	206	L213a	218B	234a
16-17b	38	56	81	98D	110	153	R173	R182	192	206b	206A	L215b	218C	234b
16-17c	39	57	83	98E	111	155	L176	183	L193	206c	206B	TR215	TL219	234c
16-17d	40	58	85a	98F	112	157	R176	183A	194	206A	207a	BB215	BL219	234d
18-19	41	59	85b	98G	113	159	177a	183B	195	200B	207b	216	R219	234e
20-21a	43	60	87	99	114a	161	177b	184A	195A	204	207c	216A	220	235
20-21b	44	61	89	100A	114b	163	177c	184B	195B	204A	207d	216B	220A	236
20-21c	45	62	91											

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- ADS
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- Page 94
- EQUIPMENT
- Page 100
- SERVICES
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- Page 194

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2	22-23b	47b	65	94B	102B	115	168	177f	185C	196A	204D	208B	L217b	221
4	24-25	47c	66a	94C	102C	116	169	177g	185D	196B	205a	209	L217c	223
6	26-27	49a	66b	95a	102D	117	170	177h	186A	196C	205b	210	L217d	229
7	28-29a	49b	66c	95b	103	122	L171a	L178	186B	196D	205c	210A	L217e	230
8-9	28-29b	49c	68	95c	104A	123	L171b	R178	184	196E	205d	211	L217f	L231
10-11	28-29c	49d	73	96A	104B	124	L171c	179	185	L197	205e	212	L217g	TR231
12-13a	32	50	75	96B	104C	125	R171	180a	L186	R197	205f	212A	217h	TR231
12-13b	33	51	79a	96C	104D	126	172	180b	187	198	205g	L213	TR231	232
12-13c	34	52	79b	97	105	145	L173	180A	188	198A	205h	TR213	88217	L233
12-13d	35	53	79c	98A	106	147	R173	181	189	L199	205i	BB213	218	TR233
14-15	36	54	79d	98B	107-108	149	174	181A	190	R199	205j	214	218A	BB233
16-17a	37	55	79e	98C	109	151	L173	L182	191	206a	206	L215a	218B	234a
16-17b	38	56	81	98D	110	153	R173	R182	192	206b	206A	L215b	218C	234b
16-17c	39	57	83	98E	111	155	L176	183	L193	206c	206B	TR215	TL219	234c
16-17d	40	58	85a	98F	112	157	R176	183A	194	206A	207a	BB215	BL219	234d
18-19	41	59	85b	98G	113	159	177a	183B	195	200B	207b	216	R219	234e
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20-21c	45	62	91											

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- 114c—Super gauge
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- L171a—Comparators
- L171b—Water analyzer

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- 205c—Heat transfer
- 205d—Screens
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# THE CORROSION-FREE WAY to handle chemicals



MUELLER BRASS CO.

# PVC

(POLYVINYL CHLORIDE)

RIGID PLASTIC PIPE AND FITTINGS



The answer to most chemical corrosion problems can be found in an installation of Mueller Brass Co. PVC rigid plastic pipe and fittings. PVC pipe has proven itself invaluable to the chemical industry because of its high resistance to corrosion. Water, oil, gases, alkaline or salt solutions, alcohol and a wide variety of acids have no deteriorating effects upon PVC. Its extremely smooth interior bore eliminates pipe clogging and fouling and assures continuous maximum flow capacity. PVC is exceptionally strong, retaining its dimensional stability under stress, impact and moderately high temperatures. Mueller Brass PVC's life long built-in finish reduces maintenance costs and completely eliminates the need for painting or other protective coating. It is light and can be easily joined by threading or solvent cement, thus saving on installation time and expense.

For more efficient, economical and corrosion-free systems, specify Mueller Brass Co. PVC plastic pipe and fittings.

**NORMAL IMPACT PVC**—good impact strength . . . maximum chemical resistance.

**HIGH IMPACT PVC**—maximum impact strength . . . high chemical resistance.

Pipe is fabricated in 20' lengths;  $1\frac{1}{2}$ " through  $3\frac{1}{2}$ " sizes—1-P.S. schedules 40 and 80. Fittings are available in  $1\frac{1}{2}$ " through 3" sizes; threaded and socket-type for schedule 80 and in socket-type only for schedule 40.



Write for the new  
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## MUELLER BRASS CO. PORT HURON 51, MICHIGAN

274-A

POLYETHYLENE PIPE AND PLASTIC FITTINGS, COPPER TUBE, VALVES AND FITTINGS

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**Lift Trucks** . . . . A 12-page brochure covers the performance, construction and maintenance of the new Challenger 60, 70 and 80 pneumatic-tire lift truck series.

204A **Hyster Co.**

**Tractor-Shovels** . . . . "Payloader" is available for the HA model with 2,000-lb. carry capacity up to 4-wheel-drive 9,000-lb. carry capacity unit. Data.

185 \*The Frank G. Hough Co.

**Utility Can** . . . . The new Dome-top Hi-Stacker makes every inch of shipping, storage & display space count. Easy to fill, easy to handle. Further details are available.

185 \*Continental Can Co.

## Heating & Cooling

**Air Cooler** . . . . Rotary indirect Air Cooler has been developed to cool products with high temperature 1200 to 1600 F. Catalog A gives full details.

BR231 \*Davenport Mach. & Fdry. Co.

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145 \*Henry Vogt Machine Co.

**Heat Exchanger Equipment** . . . . The 162-page Condenser Tube Handbook answers problems, questions involving heat exchanger equipment. It is available now.

56 \*Bridgeport Brass Co.

**Heat Exchangers** . . . . The Polybloc impervious graphite heat exchanger is outlined in Engineering Manual PB-EM102. Includes illustrations, design data & other products.

204B \*The Carbone Corporation

**Heat Exchangers, Plate** . . . . require but one-fourth the transfer surface of a shell and tube exchanger operating at equal throughput capacity. Information available.

28-29c \*The De-Laval Separator Co.

**Heat Transfer** . . . . New Multi-Zone Plate-coil provides a reserve of heating & cooling capacity for faster heat transfer. Bul. P61 gives complete specifications.

62 \*Tranter Mfg. Inc., Platecoil Div.

**Insulation** . . . . Heat-Shield, a highly efficient thermal insulating material consisting of refined mineral fibers and binders, is sprayed on by machine. Bulletin I-10.

204C \*Columbia Acoustics

**Kilns, Rotary** . . . . Feature: self-aligning bearing pedestals, truly effective air seals & stationary firing hood. Built in any length or diameter.

L213 \*Kennedy Van Saun Corp.

**Kilns, Rotary** . . . . Bulletin No. 1115 gives complete information on these kilns as well as details of the precision built & rugged machinery for chemical processing industry.

54 \*Traylor Engineering & Mfg. Co.

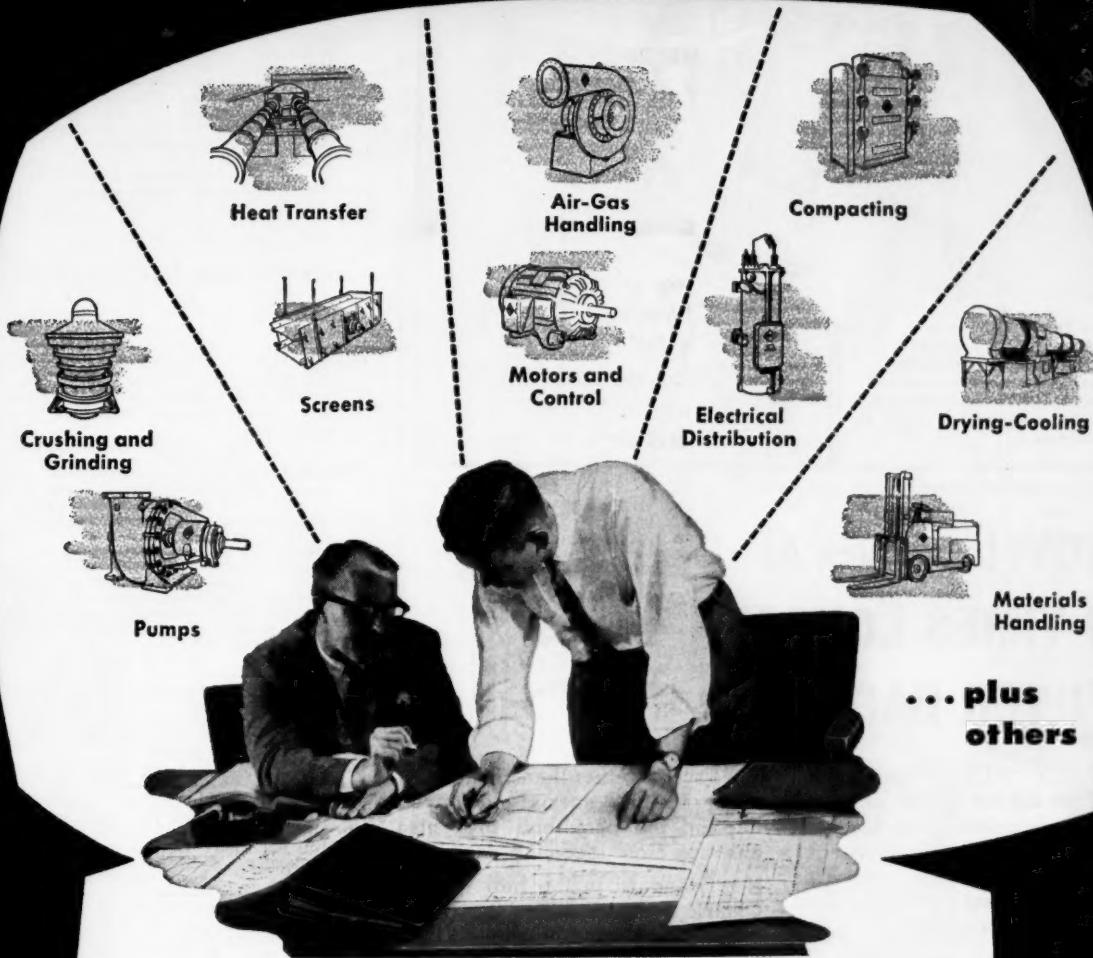
**Packaged Steam Generator** . . . . Brochure includes features, standard and optional equipment on manufacturer's line of packaged steam generators. Capacities, dimensions.

204D \*Foster Wheeler Corp.

\* From advertisement, this issue

SCOPE of  
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**ALLIS-CHALMERS**



**ONE man can provide  
all this "teamed" equipment**

He's your Allis-Chalmers representative. *One inquiry* to him and much of the equipment for any process expansion or modernization is available.

**Time and money-saving** advantages of this single source are obvious. Further, you're assured of "teamed" equipment, engineered by A-C chemical industry specialists. And, once installed, this equipment continues to be backed by outstanding field service.

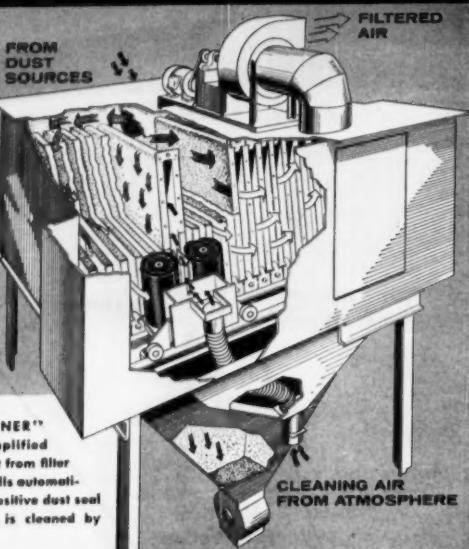
ASK "THE MAN" about the tremendous scope of A-C equipment for petro-chemicals . . . equipment that's built for the finest quality control. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

**Products for Petro-Chemicals:** Electrical Generation, Distribution and Utilization Equipment; Pumps (rotary vacuum and centrifugal); Mechanical Power Transmission Equipment; Processing Machinery (mills, kilns, screens, etc.); Water Conditioning Systems, plus Materials Handling Equipment.



A-5983-C

# NEW SLY DYNACLONE® DUST FILTER



NEW "ROLLER CLEANER" provides greatly simplified method of cleaning dust from filter bags. Resilient rubber rolls automatically adjust to form a positive dust seal as each row of bags is cleaned by atmospheric air.

Patent Nos. 2583039, 2695681, 2867289. Other Patents Pending.

## NOW! As Much As 3 TIMES LONGER FILTER BAG LIFE

NEW SLY "RESIST-O-WEAR" FILTER BAGS (patent pending) provide complete dust filtration with as much as three times longer life than conventional bags. This has been proved on the toughest field installations.

The new bag has three equal-size sections. Each pocket has two spacers, making a total of six per bag. Weight is distributed on

three seams rather than one, minimizing strain. A special protective flap on the back end prevents abrasion from incoming dust.

Now standard in the new "Roll-Clean" Dynaclone, Sly "Resist-O-Wear" bags combine with all the other superior Dynaclone features to assure greatest dust collecting efficiency with unequalled maintenance-free service.

### ALL THESE FEATURES IN ONE DUST FILTER

- New "Resist-O-Wear" bags last as much as three times longer.
- Constant suction at dust sources—complete dust collection.
- Automatically self-cleaning for continuous operation.
- Free-rolling cleaner. Complete dust seal—automatic seal adjustment.
- Greater filtering capacity; smaller space requirements.
- Simplified construction for ease of inspection and servicing.

SEND FOR New Bulletin 105 and New 36-page Dust Control Catalog 104.



THE W. W. SLY MANUFACTURING CO.

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OFFICES IN PRINCIPAL CITIES

OVERSEAS LICENSEE: ANDREW AIR CONDITIONING LTD., LONDON S.W. 1, ENGLAND

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**Steam Traps** . . . . A 48-page book tells how to correctly size, install & maintain steam traps for any pressure, temperature or any load. Also catalog data on all types. 63 \*Armstrong Machine Works

**Steam Traps** . . . . The TD steam trap can be installed in tight places. Literature Kit "2A" plus latest bulletins on this and other steam traps are offered. 116 \*Sarco Company, Inc.

**Vaporizers** . . . . using Dowtherm have been supplied for over 600 installations in sizes ranging from 44,500 Btu/hr to 45,000,000 Btu/hr. Information available. 75 \*Foster Wheeler Corp.

### Instruments & Controls

**Comparators** . . . . Handbook, "Modern pH and Chlorine Control" gives the theory and application of pH control. Illustrates and describes the full line. L171a \*W. A. Taylor & Co.

**Control, Liquid Level** . . . . available for controlling level changes from  $\frac{1}{4}$ " to 150 ft. Multi-stage switching when desired. Detailed information is available. BR233 \*Magnetrol Inc.

**Controls** . . . . Information on controls service including transmitters, The Libratrol-500 digital computer, data-processing systems & valve actuators is available. 103 \*G P E Controls, Inc.

**Data Handling Systems** . . . . Bulletin MSP-154 presents a new concept for logging, monitoring & integration of process information. Available now on request. 206A \*Hagan Chem. & Controls, Inc.

**Electronic Computer** . . . . for automatic computation with no limitation on the complexity of system. Offers full accuracy. Details available on request. 106 \*Blaw-Knox Co.

**Gauges** . . . . Complete details on Tank Content Gauges are now available. All models feature large easy-to-read dials. Remote reading . . . no power required. TR215 \*The Liquidometer Corp.

**Instrument, Control Switches** . . . . Construction features of Type 210 instrument and control switches, and their advantages are described in the new bulletin, 14B8112B. 206B \*Allis-Chalmers

**Instrumentation** . . . . Portable & process-mounted instrumentation for every phase of chemical processing & research. Information on viscosity control. TR217 \*Brookfield Eng. Laboratories

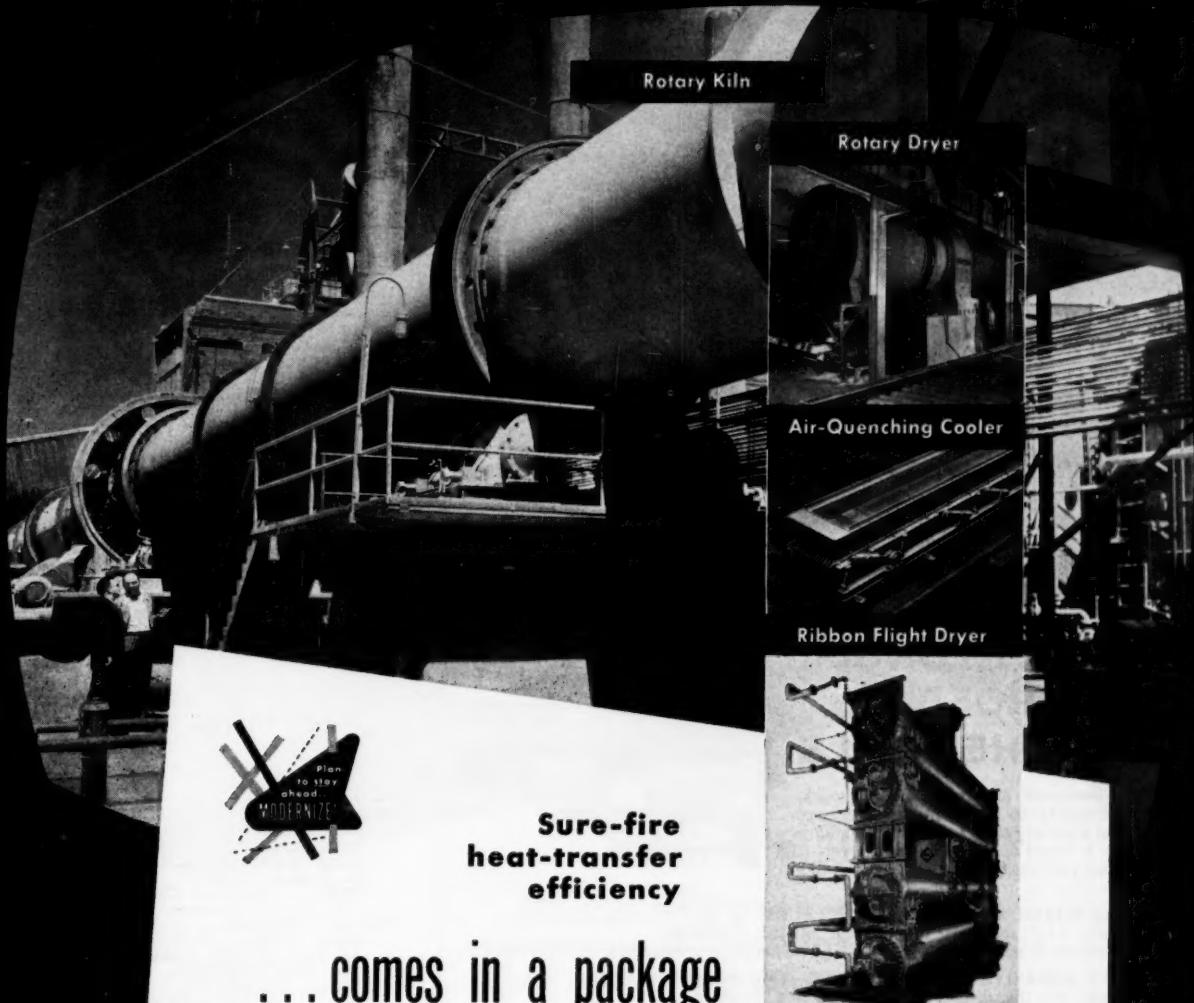
**Measuring System** . . . . Pressurized reference electrodes open new areas of pH control . . . in process streams up to 100 psi . . . at temp. up to 212 F. Data File P-7-14. 87 \*Bechman Instruments, Inc.

**Meters**, Displacement . . . . measure liquids accurately up to 100 gpm, insuring greater uniformity of product. Meters measure volumetrically. Complete information. 191 \*Buffalo Meter Co.

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SCOPE in INDUSTRY  
SPECIALIZATION from...

**ALLIS-CHALMERS**



**Sure-fire  
heat-transfer  
efficiency**

... comes in a package

A HARD-WORKING kiln—particularly an Allis-Chalmers kiln—has a burning desire to cut costs, increase chemical production and improve quality. But that kiln's fired-up ambition just smolders *unless* it is associated with equally efficient equipment in a well-designed flow.

As the world's leading producer of rotary kilns, dryers and coolers, Allis-Chalmers is concerned with the entire heat-transfer operation . . . the evaluation of variables . . . the integration of interdependent equipment, old and new, into a profitable process. Flow design, prerecommendation research and testing, and installation advice are all part of the Allis-Chalmers package.

Ask your A-C man for Bulletin 25C6177, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. In Canada, write Canadian Allis-Chalmers Ltd., Box 37, Montreal, Quebec.



A-5954



## LAST LONGER IN CORROSIVE CHEMICALS

Garlock Chemiseal® Mechanical Seals possess greater immunity to corrosion and are more economical than any other design offered. This reputation is based on fact—customers report unsurpassed performance on applications like these:

- Pumping HYDROXYACETIC AND SULFURIC ACID  
1750 rpm, 1 1/2" shaft, 10 lbs. suction, 60 lbs. discharge. Temperature of medium 30° C. RESULT: Chemiseal greatly extended service life.
- HIGHLY ABRASIVE SERVICE (ESTER—10% SOLIDS SLURRY)  
3600 rpm, 625 lbs. discharge, 30 lbs. suction. Stuffing box pressures 15 lbs. to 65 lbs. Temperature of medium 70° C. RESULT: Chemiseal gave longer, leak-proof operation.
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- Pumping ADIPIC ACID AND HYDROCARBON SLURRY  
1750 rpm, 1 1/2" shaft, 35 lbs. suction, 75 lbs. discharge. Temperature of medium 70° C. RESULT: Chemiseal lasted longer, cut downtime.

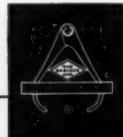
Join the list of satisfied users. You can apply standard Garlock Chemiseal Mechanical Seals to all pump shafts from 1/8" to 2 1/2". Special sizes also available. They seal against all mediums—including solids in suspension—in pressures to 100 psi at 75° C., or 75 psi at 100° C. Chemiseal Mechanical Seals are another of the Garlock 2,000 . . . two thousand different types of gaskets, packings, and seals for every need. Find out complete details by contacting your local Garlock representative, or write for Catalog AD-164.

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**GARLOCK**

Packings, Gaskets, Oil Seals, Mechanical Seals,  
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## LITERATURE . . .

**Meters, pH** . . . Three models: Research .02pH, Laboratory .05pH, Industrial .10pH. Cambridge pH equipment also includes single & multi-point recorders. Bulletin 910. TL219 \*Cambridge Instrument Co., Inc.

**Pressure Regulator Pilot** . . . Catalog sheet describes The Atlas Fig. 8000 super-sensitive pressure regulator pilot for steam, gases and liquids. Sizes 1/2 to 12 in. 208A Atlas Valve Co.

**Recorder** . . . The Transcope Pneumatic Recorder (90J) features unconfused readability front adjustments, plug-in set point transmitters, etc. Details in bulletin 14-15 \*Taylor Instrument Co.

**Thermometer, Bi-Metal** . . . with Maxivision Dial is suitable for indoor or out-door service. Sizes & temperature ranges for the most exacting requirements.

111 \*Manning, Maxwell & Moore, Inc.

**Transmitter, Indicating Pressure** . . . Its open-face, horizontal, 4" indicator scale & eye-catching red pointer are clearly visible as far away as 20 feet. Details.

51 \*The Foxboro Co.

**Transmitters** . . . Two new f/b line models permit new accuracy in measuring flow & differential pressure. Applications for steam, air, gases, water, etc. Information.

112 \*Bailey Meter Co.

**Weighing Instrument** . . . forms a low maintenance system to control processing or materials handling by weight. Literature on its application to filling, batching, etc.

L182 \*Thayer Scale Corp.

## Pipe, Fittings, Valves

**Ductile Iron** . . . Catalog describes a complete line of ductile iron products, including grades, specifications, dimensions and weights for 2- to 48-in. piping.

208B American Cast Iron Pipe

**Fitings Weldings** . . . Available in sizes 1/2" through 24". Schedules 5S through 160. Stainless types 304, 304L, 316, 316L, 347; Monel, Nickel, Aluminum 6 \*Flowline Corp.

**Pipe & Fittings, Plastic** . . . Technical Brochure gives complete sizes & specifications on PVC pipe & fittings. Offers high resistance to corrosion.

204 \*Mueller Brass Co.

**Pipe & Fittings, PVC** . . . Bulletin PF1200 contains data relative to physical properties, chemical resistance, pipe, threaded fittings & socket fittings.

TR233 \*Luzerne Rubber Co.

**Pipe & Tubing, Stainless Steel** . . . A new 44-page handbook contains data on applications, heat treatment, corrosion resistance, chemical & physical analysis, etc.

109 \*Damascus Tube Co.

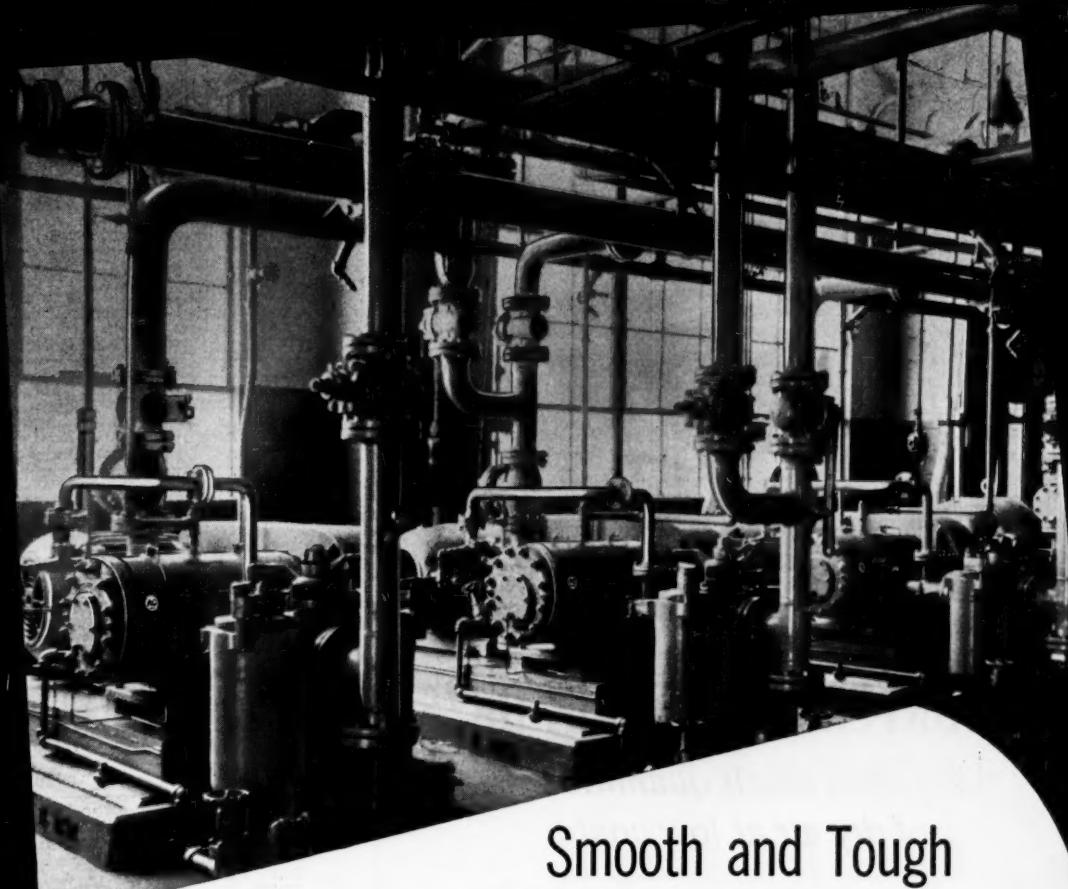
**Pipe, Glass** . . . Bulletin PE-3, "Pyrex brand Double-Tough Glass Pipe and Fittings" contains facts & figures about pipe for handling corrosives. Available on request.

22-23a \*Corning Glass Works

\* From advertisement, this issue

Full SCOPE of  
COMPRESSORS from...

**ALLIS-CHALMERS**



## Smooth and Tough

**Ro-Flo compressors**  
**eliminate underlying causes**  
**of high maintenance**



Ro-Flo compressors stand up as no other compressors can, on such jobs as agitating, aerating, air lifting, filter service, removing press cake from filters, and calking tank and pipe lines.

The inherent wear and tear from the vibration and shock of reciprocating machines is eliminated in the smooth *Ro-Flo* rotary action. The fall-off in efficiency, inevitable with other units, never takes place with a *Ro-Flo* compressor.

For smoothness, for toughness, for simple installation and easy maintenance choose a *Ro-Flo* compressor.

Contact your nearby A-C office, or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin.

Ro-Flo is an Allis-Chalmers trademark.



A-5960-C



## LECTRODRYER® BUDGET AIR DRYER

*supplies small quantities  
of dry air at low cost*

If your requirements for very dry air are relatively small—but highly important—you'll find the new Budget Air Dryer tailor-made for your needs. An investment in large equipment is not needed. The Budget Dryer is modestly priced, easily installed and serviced, operates on any 110 volt a.c. line.

This entirely new unit supplies up to 20 cubic feet per minute of air, dried to a dewpoint of  $-60^{\circ}\text{F}$  or lower. Operation is completely automatic. Likewise, the unit is as foolproof as possible, operating independently of variations in air pressure. Rugged construction and a long operating cycle assure trouble-free use.

Lectrodryer Budget Dryers are standard units, available from stock, shipped ready for installation. For complete information on this new unit and its low cost, write for Bulletin B6A, Pittsburgh Lectrodryer Division, McGraw-Edison Company, 303 32nd St., Pittsburgh 30, Pa.

# Lectrodryer



### LITERATURE . . .

**Pipe Joint Clamp**.....Stops leaks at joints where pipe is screwed into a fitting. Any temperature, pressures up to 2,000 pounds. It prevents shutdowns.

159 \*M. B. Skinner Co.

**Pipe, PVC**.....Koroseal has high impact resistance, it threads easily and can be cut, welded or drilled. Booklets on Koroseal Pipe & Koroseal Sheet are offered.

1 \*B. F. Goodrich

**Pipes**.....Bulletin CE-56 gives facts on all-purpose rigid PVC. Sched. 40, 80, & 120 in  $\frac{1}{2}$  to 4". Also information on solketal-weld fittings & valves  $\frac{1}{2}$  to 2".

180b \*American Hard Rubber Co.

**Piping**.....Type S piping systems can end problems of corrosion, erosion & contamination. Liner & housing are in thermal equilibrium. Details in Bul. TS-1A.

149 \*Resisto-Flex Corp.

**Seals**.....The Dura seal is unaffected by corrosives. They seal abrasive liquids and adjust automatically. Adaptable to standard stuffing boxes. Information.

1172 \*Durametallic Corp.

**Seals, Mechanical**.....Chemiseal Mechanical Seals for all pump shafts from  $\frac{3}{8}$ " to  $2\frac{1}{2}$ ". Special sizes also available. Complete details & Catalog AD-164.

208 \*The Garlock Packing Co.

**Tubing**.....The new data book and catalog give complete details on Penflex tubing. Available in steel, bronze & stainless steel from  $\frac{1}{8}$ " I.D. to 24" I.D.

1175 \*Pennsylvania Flexible Tubing Co.

**Valve**.....No. 47x, 150-lb. solid wedge disc steel gate type is available in 2 to 24 in. Other types for oil, oil vapor, steam or water service. Details on request.

123 \*Crane Co.

**Valve, All-Glass Y**.....The new Bulletin PE-4 offers complete information on the all-glass Y-valve. Now available in  $1\frac{1}{2}$ " and  $2\frac{1}{2}$ " sizes. Send for your copy.

22-23b \*Corning Glass Works

**Valve, PVC**.....for corrosive services in paper mills, chemical plants, food processing, beverage bottling, petroleum refining, etc. Confidential Corrosion Service Form offered.

37 \*The Lunkenheimer Co.

**Valves**.....Bulletin 11 describes stainless steel valves with replaceable Teflon disks or seats. Covers globe, Y, check, needle and plug gate designs.

210A \*Alloy Steel Products Co.

**Valves**.....Butterfly valves feature uniform control in all position & fast regulation & closure. Information on Rotovalves & butterfly, wafer & ball valves available.

R199 \*Allis-Chalmers, Hydraulic Div.

**Valves**.....Type K "Y" valves are available in Durimet 20, Durco 18-8-S-Mo, Monel, Nickel, Chlorimet 2 & Chlorimet 3. Complete details of construction in Bul. V7a.

165 \*The Duriron Co., Inc.

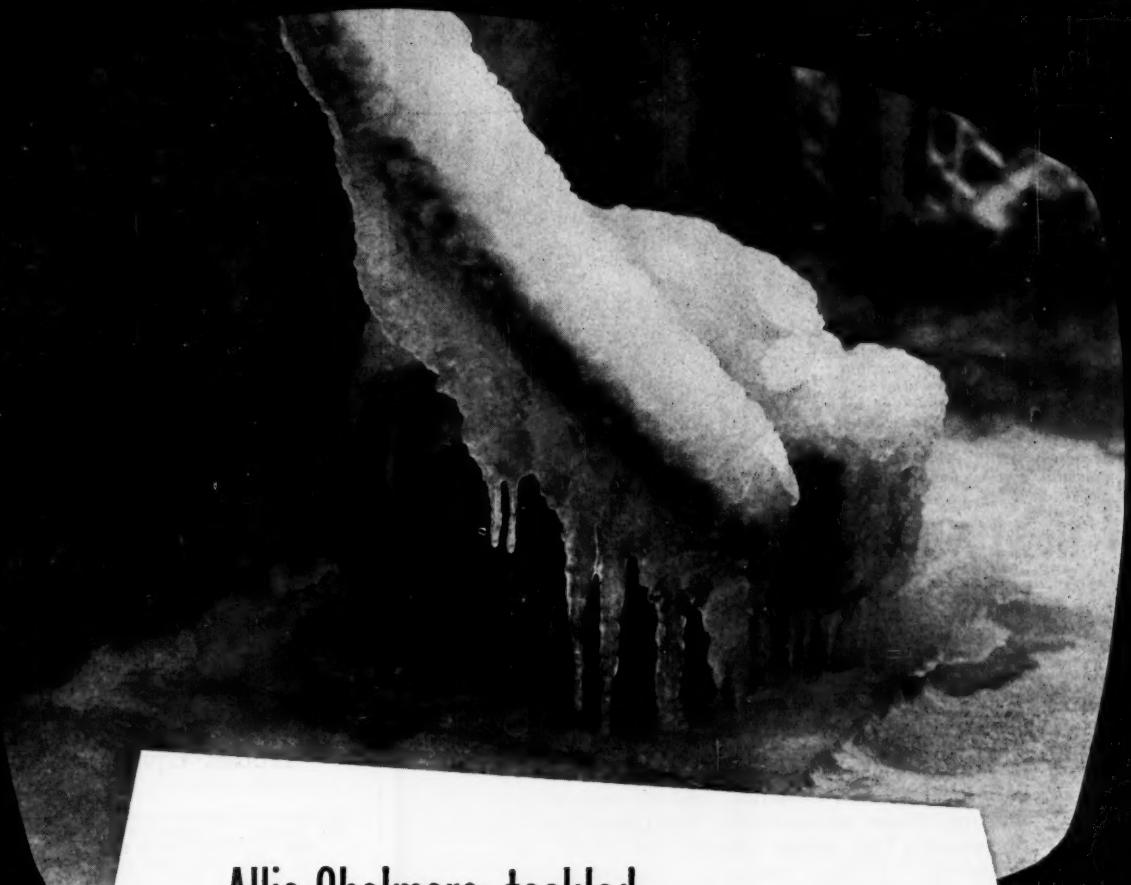
**Valves, Acid Proof**.....Many types available in Tufclad chemical porcelain in  $\frac{1}{2}$ " to 6" sizes. Description & specifications on the entire line is available.

61 \*Lapp Insulator Co., Inc.

\* From advertisement, this issue

SCOPE in MOTOR  
DEVELOPMENT from...

**ALLIS-CHALMERS**



## Allis-Chalmers tackled this motor problem "COLD"

Even heavy icing couldn't freeze this motor. An Allis-Chalmers customer required that this open-type *Super-Seal* motor (with *Poxeal* insulation) start even though imbedded in ice.

The successful tests were conducted in the A-C Motor Laboratories where customers' motor needs point the way to continuous development programs.

**Research**, combined with testing of this type, has established Allis-Chalmers as a pioneer-leader in the motor industry. It has led to the most complete line of integral-horsepower motors; it has led to tremendous acceptance of such A-C developments as *Synduction* and tube-type motors, and now *Super-Seal* motors.

**Your chemical processes** can benefit from this pioneer-leadership by contacting your A-C representative or distributor, or writing Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

*Poxeal, Synduction and Super-Seal are Allis-Chalmers trademarks.*

A-5956-C



Patent Pending

A standard preassembled control panel is provided with all Amplitrol feeders, and is ready for immediate service when external air and a-c power connections are made. Control can be local or remote, manual or automatic. Responds to any standard process instrumentation.

## Now! A Mechanical Vibrating Feeder With Variable, Stepless Control

The exclusive *Carrier Natural-Frequency drive*, and a unique new amplitude control system — these two features of the new Carrier Amplitrol feeder give you benefits found in no other vibrating feeder, electromagnetic or mechanical.

**LESS DAMPING** . . . Amplitrol feeders increase vibrating stroke automatically when headload is increased. This allows you to use larger bin openings . . . bigger headloads . . . and to discharge bigger capacities of almost any material.

**FULL-RANGE CONTROL** . . . A new, highly simplified pneumatic system allows accurate, full-range stroke control. The heavy-duty air springs respond immediately to a pneumatic signal from a standard 0-80 psi air pressure valve. No lag.

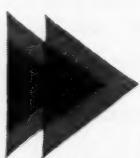
**LESS MAINTENANCE** . . . Amplitrol feeders have no chains or v-belts . . . no large revolving weights or bearings . . . no auxiliary electrical parts . . . no gears or guards . . . **NEW AMPLITROL FEEDERS ARE JUST THAT SIMPLE.**

Send for new 12-page bulletin describing all Amplitrol benefits in detail. Carrier Conveyor Corporation, 211-A North Jackson Street, Louisville, Ky.

**CARRIER**

**NATURAL-FREQUENCY<sup>®</sup>**  
**VIBRATING EQUIPMENT**

Engineering Specialists in Vibrating Equipment



CONVEY • FEED  
DEWATER • SCREEN  
COOL • AGGLOMERATE  
DRY • SCALP • COAT  
DISTRIBUTE • ELEVATE

### LITERATURE . . .

**Valves, Drain** . . . cannot clog up. Designed so that in the closed position the piston or ram extends up into the tank. In open position, full flow assured. Catalog L176 \*Strahman Valves, Inc.

**Valves, Fittings, Piping** . . . Catalog 356 contains complete details including charts, diagrams & other illustrations on jacketed piping, fittings, plug valves, joints, etc. 212A \*Parks-Cramer Co.

**Valves, Gate** . . . Rubber-lined type with special alloy working parts are made for pressures to 150 lbs. & temp to 150. Catalog No. 57 covers all types of gate valves. 195 \*Darling Valve & Mfg. Co.

**Valves, Knife Gate** . . . available in a wide range of metal combinations & in several different styles. Handle corrosive chemicals. Details in Bulletin 300. 44 \*DeZurik Corporation

**Valves, Plug** . . . are available in semi-steel, Ni-resist, carbon steel, bronze & aluminum. Lubricant protects against corrosion. Details in Catalog 400. 57 \*W-K-M Div. of ACF Industries

**Valves, Plug** . . . available in sizes  $\frac{1}{2}$ " through 16" depending on the type required. Complete information in the new lubricated plug valve catalog, #PV-5. 153 \*The Wm. Powell Co.

**Valves, Stainless Steel** . . . A new catalog outlines patterns you want, in a choice of alloys that satisfy the requirements of practically all corrosive services. 117 \*Jenkins Bros.

### Process Equipment

**Air Dryer** . . . operates on any 110 volt a.c. line. Unit supplies up to 20 cubic feet per minute of air, dried to a dewpoint of 60 F. or lower. Bulletin B6A. 210 \*Pittsburgh Lectrodryer

**Automatic Palletizer** . . . Completely automatic, operatorless unit is specifically engineered to slash production costs in 2 & 3 shift plants. Bulletin L199 \*Miller Engineering Corp.

**Blender, Ribbon** . . . is designed to give top mixing efficiency & meet sanitary codes. Nine different size units ranging from 16 to 300 cu. ft. working capacity. 105 \*The Strong Scott Mfg. Co.

**Centrifugal** . . . Low product moisture, high capacity & economical operation are functions of the Reineveld Centrifugal. Complete information in Bulletin 356. 85a \*Heyl & Patterson, Inc.

**Centrifugals** . . . for liquid-solids separation. Literature on Batch-O-Matic, Batch-Master, Suspended, Center-Slung, Maxi-Flex and Continuous is now available. 20-21a \*American Mach. & Metals, Inc.

**Conveyor, Screw** . . . 17 basic screw designs, available in a variety of metals, are included in the line. Also, complete line of troughs, gates, drives, etc. Data 2289. 83 \*Link-Belt Co.

\* From advertisement, this issue

# KENNEDY ROTARY KILNS

for

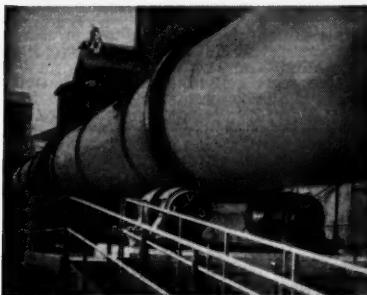
Lime

Calcined Coke

Dead Burned Dolomite

Cement—Wet or Dry Process

Nodulizing and Agglomerating  
Drying



Compare these KENNEDY Features:

- Self-aligning bearing pedestals.
- Stationary firing hood with swinging entrance ports for quick, easy internal access.
- Truly effective air seals.
- Drive gear mountings avoid thermal stresses.
- Built in any length or diameter.
- Designed to give economical, efficient operation over long periods.

FOR ADDED ECONOMY—Preheaters for your new or existing kilns: KENNEDY Multi-vane Internal Recuperator—KENNEDY-Grudex Preheater—KENNEDY External Stone Preheater.

Suppliers to the Chemical Industry of crushing, grinding and pulverizing machinery, complete cement and lime plants, size separation equipment and pneumatic conveying components and systems.



**KENNEDY VAN SAUN**

MANUFACTURING & ENGINEERING CORPORATION  
405 Park Ave., N. Y. 22, N. Y. • Factory: Danville, Pa.

**ROLLOCK**  
SPECIALIZED WELDED FABRICATIONS

for example

## VACUUM RETORTS

HEAT AND CORROSION RESISTANT



This heavy INCONEL Vacuum Retort is one of a number of such designs being produced by ROLOCK. Approximately 2 feet in diameter by 8 feet high, it is used for high-temperature vacuum annealing.

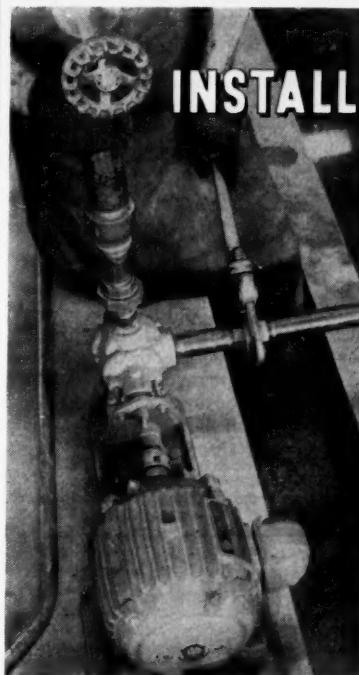
By entrusting such work to ROLOCK, you gain the many advantages of competent engineering supervision; production personnel thoroughly experienced in the problems and materials involved; a modern plant fully equipped for inspection and testing as well as fabrication.

Rolock facilities and skills cover a wide range of work in pressure and vacuum equipment, specialized processing carriers, furnace retorts, covers and bells, trays, tanks, fabrications and assemblies in Inconel, Incoloy, Monel, the Hastelloys, and Stainless Steels. Send us an outline of your requirements.

Put your problems up to:

**ROLLOCK INC., 1340 KINGS HIGHWAY, FAIRFIELD, CONN.**

DR. 5500



INSTALL

**VIKING PUMPS**

### FOR LOW FIRST COST

The size range of Viking Pumps (largest in the rotary pump industry) permits you to choose the pump to fit your job—thus, pay no more than the job requires.

### FOR LOW OPERATING COST

The positive, smooth delivery of all Viking Pumps cuts horsepower requirements, reduces wear on valves and meters, permits less costly installations. No priming gadgets.

### LOW UPKEEP COST

The simplicity of Viking's "gear-within-a-gear" pumping principle cuts maintenance, labor and parts to a minimum. For the pumping service received, you will find nothing more simple.

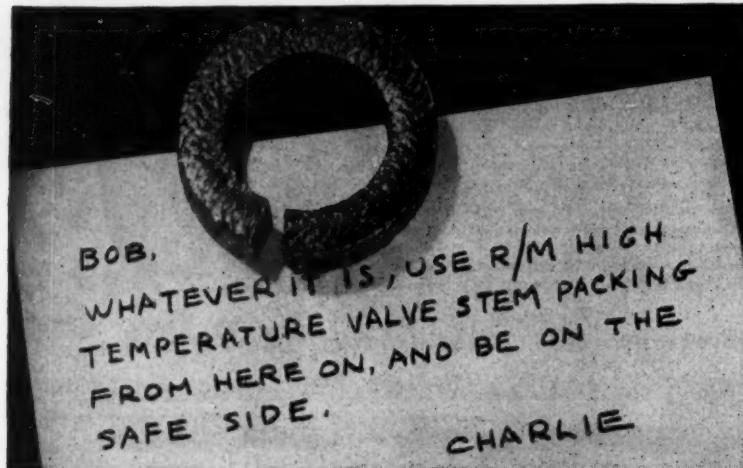
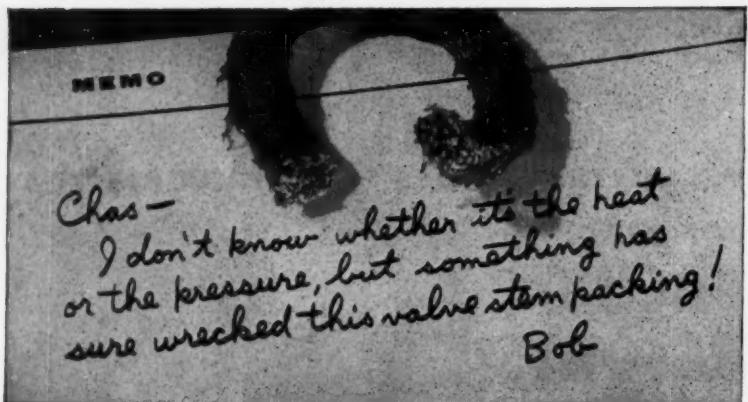
Send today for  
Bulletin series 595C



**VIKING PUMP COMPANY**

Cedar Falls, Iowa, U.S.A. In Canada, it's "ROTO-KING" pumps

See Our Unit in Chemical Engineering Catalog



R/M's experienced packing engineers designed this line of packings to help you lick the problems caused by higher temperatures and greater pressures in today's processing lines. R/M High Temperature Valve Stem Packings contain practically no organic materials—and it is these organic materials which cause a lot of your trouble by burning and causing volume loss. Lubricants are ground in during manufacture; so they are thoroughly dispersed all through the packing. And braided asbestos yarn provides you with the maximum performance in pressure resistance.

Among the other packing products

R/M MAKES A COMPLETE LINE OF MECHANICAL PACKINGS—including Vee-Flex, Vee-Square, Universal Plastic, and "versi-pak"; GASKET MATERIALS; "TEFLON" PRODUCTS. SEE YOUR R/M DISTRIBUTOR.

\*A Du Pont trademark

engineered by Raybestos-Manhattan to meet difficult requirements are "Teflon" and "versi-pak." "Teflon" packings, because they show no reaction to any known industrial acids or caustics and are noncontaminating, can be of great help to you in a variety of applications. "versi-pak" is a highly engineered nonjacketed packing offering excellent performance with solvents, weak acids, and caustics over a wide range of conditions. Due to the many applications of both these packings, we suggest that you call on R/M's experienced packing engineers for specific recommendations. Their service is at your disposal.



**PACKINGS**  
RAYBESTOS-MANHATTAN, INC.  
PACKING DIVISION, PASSAIC, N.J.  
MECHANICAL PACKINGS AND GASKET MATERIALS

RAYBESTOS-MANHATTAN, INC., Mechanical Packings • Asbestos Textiles • Industrial Rubber • Engineered Plastics  
Sintered Metal Products • Abrasive and Diamond Wheels • Rubber Covered Equipment • Brake Linings  
Brake Blocks • Clutch Facings • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls

## LITERATURE . . .

**Cyclone** . . . for classifying or thickening slurries. A complete line of various sizes & capacities of Cyclones are covered in Bulletin No. 1157.

85b \*Heyl & Patterson, Inc.

**Cyclones** . . . A 12-page booklet "The Exclusive Buell Cyclone" is available. Shave-off design permits large diameter cyclones that will not clog or plug.

R175 \*Buell Engineering Co., Inc.

**Dryer** . . . The multiple conveyor dryer for synthetic rubber crumb provide accelerated production & high uniformity in drying of this difficult-to-handle material. Literature.

89 \*The National Drying Mach. Co.

**Dryer** . . . Hydryer continuously removes moisture from gas or air stream at full line pressures. Bulletin gives application details, selection tables, etc.

TR231 \*J. F. Pritchard & Co.

**Dryers & Mixers** . . . Units are fabricated of stainless steel & are self-contained. Technical assistance is available. Further information is yours on request.

115 \*General American Transp. Corp.

**Dryer-Blender** . . . assures product purity, eliminates metallic contamination & retards product adhesion. Complete information available on request.

236 \*The Pfaudler Co.

**Equipment** . . . Complete information on equipment for your requirements is now available. Included are vibrating feeds, belt conveyors, bark & grit removal equipment.

36 \*The Jeffrey Mfg. Co.

**Filter, Dust** . . . Complete specifications, typical equipment layouts, capacity & performance of the Reverse Jet Dust filter are contained in Bulletin F-75.

220 \*The Day Company

**Filter Media** . . . Feon is available by the roll or tailored to fit all types of fluid/solid separation process equipment. Literature is available on request.

2021d \*American Mach. & Metals, Inc.

**Filters** . . . Vertical leaf models in both horizontal & vertical tank designs, Batch-Miser in horizontal plate models for polish filtration & batch operations. Lit.

20-21c \*American Mach. & Metals, Inc.

**Filters** . . . Fulfilo filters are available in a wide range of models for high or low flow rate, pressure, viscosity, pH or temperature. Technical literature is available.

32 \*Commercial Filters Corp.

**Filters** . . . Precoat filters feature replaceable razor-sharp stellite blades in machined recesses. Bulletin KSI-3 covers all types of filters that are available.

99 \*Komline-Sanderson Engr. Corp.

**Filters, Continuous** . . . Literature on pressure type continuous filters with vacuum or pressure rotary drum and horizontal table is now available.

20-21b \*American Mach. & Metals, Inc.

**Filters, Dust** . . . The new bag has 3 equal size sections. Each pocket has two spacers, making a total of six per bag. Other details in Bul. 105 & Dust Control Catalog.

206 \*The W. W. Sly Mfg. Co.

\* From advertisement, this issue

**D.O.James**  
Established 1888

**IN-LINE  
GEARMOTORS**



**TYPE "MG"**

IN-LINE GEARMOTOR—Horizontal or Vertical Drive, 37 sizes, ratio 9.2:1 to 1200:1, 1 to 75 H.P.

**IN-LINE  
MOTOREDUCERS**



**TYPE "MS"**

IN-LINE MOTOREDUCER—Horizontal Drive, 37 sizes, ratio 9.2:1 to 1200:1, 1 to 75 H.P.

Since 1888 • MAKERS OF  
EVERY TYPE OF GEAR AND  
GEAR SPEED REDUCER

THESE In-Line D.O.James Gearmotors and Motoreducers are of the same construction and high quality as the individual Gear Speed Reducers which we have been producing for so many years.

They cover a very wide range of ratios, horsepowers, and are an ideal, compact, efficient unit for many power and space-saving installations.

**D.O.JAMES**  
GEAR MANUFACTURING CO.  
1140 W. Monroe Street, Chicago, Illinois

TO BETTER SERVE YOU  
We staff and maintain Sales and Engineering Offices thruout United States and Canada

SEND FOR CATALOGS

Catalogs, price lists and selection tables of gearmotor speed reducers and motoreducers are available to power transmission engineers. Please request on company letterhead—and we'll mail your copy at once.

**DEPENDABLE  
100% AUTOMATIC**

**REMOTE READING  
Tank Contents Gauges**

- RELIABLE
- NO POWER REQUIRED
- UNDERWRITERS' APPROVED

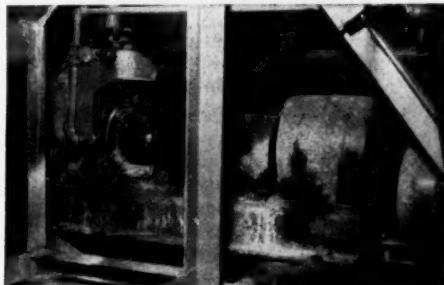
Liquidometers use a temperature compensated balanced hydraulic system. Indications unaffected by changes in specific gravity. All models feature large easy-to-read dials. UL approved switches available.

Write for complete details to  
Dept. Q.

Since 1920  *of proven quality*



**THE LIQUIDOMETER CORP.  
LONG ISLAND CITY 1, NEW YORK**



*This  
Nagle Pump  
IN OPERATION  
2 YEARS*

**—REPLACED A PUMP  
THAT LASTED 2 MONTHS**

A leading manufacturer of household appliances\* installed this Nagle 1" type H-A-W horizontal shaft pump over 2 years ago and it's still going strong. It is in the Bonderizing Dept., shown, handling phosphate slurry at the rate of 10 GPM, against a 25' head. Pump is self-priming. Simple slippage seal adjustment. Readily accessible stuffing box. Pump it replaced lasted less than two months. If you have an abusive pumping problem Nagle Pumps can cut your costs too! Send for "Pump Selector".

\*Details on request.



**NAGLE  
PUMPS**

PUMPS

FOR

ABRASIVE

AND

CORROSIVE



**NAGLE PUMPS, INC.**  
1235 CENTER AVE., CHICAGO HEIGHTS, ILL.



APPLICATIONS

# For higher pumping efficiency of solids in suspension!

**NEW**

## Fairbanks-Morse 5440A Non-Clog Pumps

Ideal for pumping unscreened liquids with large solids in suspension

- industrial wastes
- sanitary sewage disposal
- industrial processes

Here is your answer to higher efficiencies wherever you are pumping solids in suspension!

All-new Fairbanks-Morse 5440A Non-Clog Pumps feature quick, easy convertibility between any of the many vertical and horizontal types. Power requirements of the pump are always perfectly matched to the electrical and mechanical components. Precision-machined centering fits assure accurate alignment. Exclusive F-M bladeless impeller design minimizes maintenance by preventing clogging from solids and stringy material. The 5440A is only one of many F-M solids-handling pumps designed to meet a broad range of requirements. For information, write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

Ask for new  
5440A BULLETIN!



**FAIRBANKS-MORSE**

*a name worth remembering when you want the BEST*

ELECTRIC MOTORS • DIESEL, DUAL FUEL AND GAS ENGINES • PUMPS  
COMPRESSORS • GENERATORS • MAGNETOS • HOME WATER SYSTEMS

## LITERATURE . . .

**Fume Scrubber** . . . The Cross-Flow is so designed that the gas flow & liquid flow are perpendicular to each other . . . the liquid flow vertical, gas flow horizontal. Details. 12-13b \*U. S. Stoneware

**Fume Washer** . . . Designed primarily to handle relatively mild fume problems in laboratories, special departments, etc., the Cyclonaire is made in 4 sizes. Data. 12-13a \*U. S. Stoneware

**Fume Washers** . . . Full engineering data is available on Ceramic Fume Washers. Ceramic fume scrubbers can be provided in diameters up to 48" in heights up to 60" or more. 12-13c \*U. S. Stoneware

**Homogenizers** . . . handle all kinds of emulsions & fit into any plant. Feature easy cleaning & maintenance, tight emulsions, no aeration & faster emulsification. Bul. 157. 216A Sonic Engineering Corp.

**Metal Scrubbers** . . . The units may be lined with Tygon sheet lining or rubber, or unlined. Either metal, carbon, or ceramic support plates & distributors may be employed. 12-13d \*U. S. Stoneware

**Micronizer** . . . grind and classify in one operation in a single chamber. Can handle heat-sensitive materials. Eight models available . . . for full description Bul. 091. R178 \*Sturtevant Mill Co.

**Mill** . . . The Tornado Mill is a unit for granulating, pulverizing, mixing, pulping or chopping materials of all types, including wet or sticky products. Specifications offered. 221 \*F. J. Stokes Corp.

**Mill, Vertical** . . . offers wide application to a great variety of chemicals, pigments, food products, etc. Bul. #78 gives detailed information on superfine pulverizing. 124 \*Combustion Engineering Inc.

**Mills, Hammer** . . . crushes, grinds, shreds to finished size in one operation. Offers more uniform product, increased output. Catalog available. Send for your copy. 59 \*Williams Patent Crusher & Co.

**Mills, Impact** . . . available in sizes to meet individual requirements. A new bulletin tells most efficient method of achieving particle size reduction by centrifugal force. 216B Safety Industries, Entoleter Div.

**Mixers, Centrifugal** . . . New principle of high speed mixing producing intimate dispersion. Available in all sizes to meet individual requirements. Bulletin offered. 216C Safety Industries, Entoleter Div.

**Mixer, Dispersall** . . . blends, disperses, emulsifies, dissolves, mixes. Standard sizes from  $\frac{1}{2}$  to 330 gallons. Facts given in Dispersall Catalog 78. Send for your copy. R197 \*Abbe Engineering Co.

**Mixers** . . . A full line . . . side drive, tank top, portable or tripod & continuous pipeline mixers etc. For all your fluid mixing needs. Bulletin 582. 81 \*New England Tank & Tower Co.

**Mixing Machinery** . . . Bulletin No. CE-58 contains information on B-P equipment for the chemical process industries. Includes building mixing machinery. 43 \*Baker Perkins

\* From advertisement, this issue

## ATTENTION process industries gas users • utilities

NORWALK, CONN. . . NORWALK VALVE CO., 80-year-old gas control equipment firm, acquired by Eclipse Fuel Engineering Company, Rockford, Illinois.

All sales, engineering, manufacturing, and service activities have been moved from South Norwalk, Connecticut, to the Eclipse-Rockford plant. Eclipse now offers the most complete line of gas control and combustion equipment available anywhere.

Special engineering service is always available.



CHECK VALVES  
(disc and diaphragm)  
Types and sizes for every need  $\frac{1}{8}$ " to 42"



AIR/GAS LINE FILTERS  
Protection against dust and scale.  $\frac{1}{2}$ " to 8"  
125 psi.

OTHER  
NORWALK PRODUCTS:

- Pressure controllers
- Relief valves
- Appliance regulators
- District and station regulators
- Manometers
- "Meter Cop" — combination back pressure and antisuction valve.

Norwalk products are now available from Eclipse Fuel Engineering Company. Write to Rockford, Illinois for literature or information on individual products or Engineered Combustion Systems.

**Eclipse Fuel Engineering Co.**  
Rockford, Illinois

Eclipse Fuel Engineering Co. of Canada, Ltd.  
Toronto, Ontario

**Eclipse**

## INSIDE VISCOSEITY WITH BROOKFIELD AND YOU!



Right to the heart of this vital product dimension . . . that's where Brookfield can take you. Consider this an invitation to ask Brookfield to bring you up to date on how viscosity control, through Brookfield instrumentation, can be profitably applied to your processes. Viscosity measurement, recording and control can now be accomplished automatically for practically any fluid material. Low investment Brookfield portable and process-mounted instrumentation now plays a major role in practically every phase of chemical processing and research.

If Brookfield's long experience and coveted rheological know-how can be valuable to you, in-depth information is yours by writing —

World's Standard for Viscosity  
Measurement and Control

*Brookfield*  
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# Fansteel Corrosionomics

REGISTERED U. S. PATENT OFFICE

A JOURNAL OF USEFUL INFORMATION FOR THE SOLUTION OF CORROSION PROBLEMS

## TANTALUM HEATERS IN HOT HCl SERVICE SINCE 1947

In continuous service since 1947, two Fansteel tantalum bayonet heaters have solved a major corrosion problem for the A. E. Staley Mfg. Co. at Decatur, Ill. The company produces large amounts of monosodium glutamate, an amino acid salt which enhances the flavor of food. The first step in processing is the hydrolysis of several amino acids in corn gluten with hot HCl.

### Heats at 1,800,000 Btu per Hour

At the outset, approximately 15,000 lbs. of 18° to 20° Be HCl plus 100 gallons of water must be heated in one hour to 150° F. The two Fansteel tantalum bayonet heaters accomplish this in a Havig tank, under 60 psig steam. Each measures 72" long, by 1½" in diameter. In addition, acid heating cycles are regulated by a temperature controller using a thermocouple in a tantalum thermowell.

The heat transferred ranges from 1,200,000 to 1,800,000 Btu per hour, depending upon the entering temperature of the acid from outdoor storage tanks at ambient temperature. Since the bayonet heaters have an area of



Arrows indicate tantalum bayonet heaters and thermowell in Havig tank.

about five square feet, the heat transfer coefficient attained is about 1,400 Btu per hour per degree F per square foot.

### No Corrosion—Even with Continuous Exposure

As can be appreciated, corrosion is a major problem in this process—and tantalum is one of the few materials of construction that has resisted corrosive attack successfully. Three tantalum heaters were installed as original equipment, but the process now operates on two with ample heating capacity. The A. E. Staley installation, along with a host of others, have proved tantalum's complete immunity to HCl at all concentrations and temperatures up to and including constant boiling temperatures. Among these are numerous instances where tantalum equipment has been subjected to hot HCl for 15 years and more with no perceptible attack.

### Free Tantalum Test Kit

A corrosion test kit, available without charge to research technicians, if requested on your letterhead; contains both tantalum sheet and wire.

### Free Technical Information

The above condensation is typical of the articles which appear in CORROSIONOMICS, a Fansteel publication. Mail us your name for inclusion on our free mailing list.



Tantalum bayonet heater in side opening of Havig tank. Dry corn gluten is shown in hand.

For further data on the above, write:



G585A

## LITERATURE . . .

**Process Equipment** . . . . Technical information on equipment for sizing, weighing, conveying, mixing, classifying and screening is now available on request.

218A \*S. Howes Co., Inc.

**Processor, Round** . . . . used for heating, pasteurizing, cooking, mixing, cooling, holding, setting, refrigerated storing & air unloading. Information on equipment available.

45 \*Cherry-Burrell Corp.

**Pulverizer** . . . . The Jet Pulverizer is available in 8 custom made sizes in mill diameters from 2" to 36". Details and specifications outlined in illustrated brochure.

218B The Jet Pulverizer Company

**Screens, Vibrating** . . . . Bulletin outlines the important new design and high capacities for long life under rugged conditions. Available in all sizes.

218C Safety Industries, Enteletor Div.

**Wet Collector** . . . . Type N Roto-Clone combines action of centrifugal force & thorough intermixing of water & dust-laden air. Complete information in Bulletin 277.

38 \*American Air Filter Co.

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53 \*Roots-Connersville Blower

**Compressor, Rotary** . . . . Detailed information on the full line of rotary compressors for in-plant services, gas gathering, and industrial refrigeration is available.

34 \*Fuller Co.

**Compressors** . . . . Ro-Flo compressors available in 2-stage units from 250 to 1800 cfm and single-stage units from 40 to 3000 cfm. Descriptive literature is offered.

209 \*Allis-Chalmers

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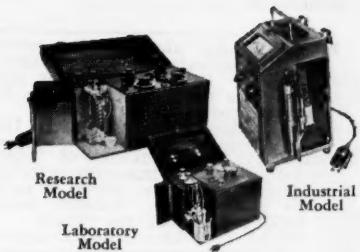
\* From advertisement, this issue

April 6, 1959—CHEMICAL ENGINEERING

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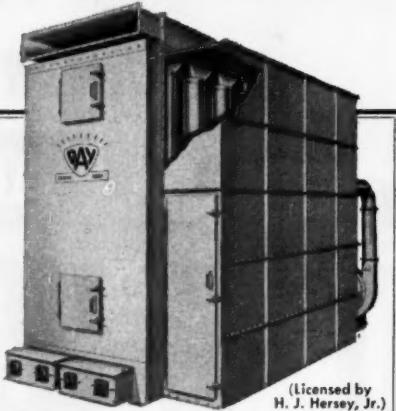
# DAY

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### DAY "AC" Reverse Jet Dust Filter

Cutaway view of DAY "AC"—available housed or un housed—for pressure or suction.



(Licensed by H. J. Hersey, Jr.)

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Filtering rates for a DAY "AC" are 10 to 20 cubic feet of air per square foot of filter media. These are about five times greater than old style filters. This means you get maximum filtration from the minimum filter investment. Because virtually 100% of the DAY "AC" is operating at all times, no money is wasted on intermittent or standby units. One DAY "AC" will filter and keep separated, dusts from up to 10 different sources!

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Because of smaller diameter felt filter tubes the DAY "AC" gives you a greater air handling capacity in less space. DAY "AC" filters occupy up to 50% less space—an important consideration for plants of any size!

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216 . . . . . \*Fairbanks-Morse & Co.

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R219 . . . . . Aurora Pump Div.

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L178 . . . . . \*The Boardman Co.

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220C . . . . . Linde Co.

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(Continued on opposite page)

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(Continued from opposite page)

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- 2—Struthers Wells 1,000 gal. 316 S.S. Jacketed Agitated Reactors.

## REACTORS—EVAPORATORS CONDENSERS—TANKS

- 1—1500 gal. Pfaudler, glass lined, jacketed, agitated Reactor.
- 1—500 gal. Walters, 304 S.S. jacketed, agitated Reactor, 4' x 5'.
- 1—1400 gal. Blaw-Knox, steel, jacketed, agitated Reactor.
- 1—350 sq. ft. Buflovak, monel, single effect Evaporator.
- 1—250 sq. ft. Buflovak, 304 S.S. forced circulation Evaporator.
- 1—20 sq. ft. Buflovak, 304 S.S. forced circulation Evaporator.
- 1—3500 gal. 304 S.S. jacketed, agitated Tank, 9' x 7'.
- 1—7500 gal. 316 S.S. Vertical Storage Tank, 7' x 25', 50 PSI.
- 1—20,000 gal. 347 S.S. Vertical Storage Tank, 12' x 23'.
- 1—750 gal. nickel clad Mixing Tank, 125# internal, with nickel coils.
- 1—4000 gal. Hayes, vertical Tank, 8' x 12'.
- 1—12,000 gal. horizontal, steel Pressure Tank, 7' x 36', 200 psi.
- 8—Stainless Heat Exchangers: 1220, 942, 786, 536, 398, 315, 256, 157 sq. ft.
- 1—24" dia. x 35', 304 S.S. Bubble Cap Column.
- 1—30" dia. x 26', 304 S.S. Bubble Cap Column.

## CENTRIFUGES

- 1—Bird 18" x 28", 316 S.S. Solid Bowl, Continuous.
- 1—Bird 24" x 38", Monel, Solid Bowl, Continuous.
- 1—Bird 18" x 28", steel, Solid Bowl, NEW.
- 2—Sharples PY14, PN14, Super-D-Centers, 316 S.S.
- 1—Sharples H2 Nozzleector, 15 HP, 304 S.S.
- 1—Bird 40" suspended, 347 S.S., perforated basket.
- 1—Bird 40" suspended, rubber covered, perforated basket.
- 1—Hercules 40" center-slung, rubber covered, perforated basket.
- 1—Tolhurst 30", 304 S.S., underdriven, perforated basket.
- 2—Sharples #16, 304 S.S., 3 HP motor

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- 4—Komarek-Greaves briquetting presses, 75 HP, 25 tons per hour.
- 4—Komarek-Greaves vertical Fluxers (paddle mixers), 150 HP.
- 4—K-G Horiz. Fluxers 41" dia., 50 HP.
- 4—K-G Pug Mills, 30" dia. x 14'4".
- 8—Tyler Screens, 4' x 8', 4' x 6'.
- 2—43" wide travelling-screen cooling conveyors, total of 950'.

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238 CFM	1000 PSI 9x8 Ing. ES
311 CFM	1500 PSI 10-1/2x7-1/2x13 IR-ES-3
465 CFM	1000 PSI 12x11-1R-ES-3
502 CFM	1200 PSI 12x11-1R-ES-3
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- 1—Oliver 53" x 8' Steel Rotary Vacuum, vapor-tite housing.
- 1—Sparkle 33S28 Filter, 150 sq. ft., 304 S.S.
- 1—Niagara 36H10 horizontal Filter, 110 sq. ft., 304 S.S.
- 1—Sparkle 33-S-17 steel Filter, 92 sq. ft.
- 1—#12 Sweetland Filter, 48 leaves, 3" centers, 640 sq. ft.
- 2—#10 Sweetland Filters, 27 leaves, 4" centers, 250 sq. ft.

## DRYERS

- 1—Devine Vacuum Shelf with 10-59" x 78" shelves.
- 1—Devine Vacuum Shelf with 10-40" x 43" shelves.
- 2—Overture 42" x 120", Atmospheric, Double Drum.
- 2—Devine 5" x 12", 4" x 9", Atmospheric, Single Drum.
- 1—Buflovak 3" x 20' Rotary Vacuum Dryer, 316 S.S., Unused.
- 2—Louisville Rotary Steam Tube, 5' x 20', 6' x 50'.
- 1—Rotary Kiln, 9' x 130'.
- 4—Rotary Dryers, 4" x 40', 6' x 50', 5' x 50', 5' x 30'.
- 2—Link Belt: 7-1/2" x 25' Monel, 6'4" x 24' 316 S.S., Roto Louvre Dryers.
- 3—Louisville 8" x 50' Stainless Steel lined Rotary Dryers.
- 2—Vulcan 7' x 80' Rotary Dryers.

## MIXERS

- 1—Baker Perkins 316TRM, 150 gal., jacketed, sigma blades, Vacuum, 50 HP motor.
- 5—Baker Perkins #15 JIM2, 100 gal. jacketed, sigma blades, 20 HP motors. UNUSED.
- 5—Day "Cincinnati" double arm, 250 and 100 gal.
- 3—1500# Powder Mixers, 7-1/2 HP XP motor.
- 3—Steel, jacketed Powder Mixers; 50, 225 and 350 cu. ft.

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- 2—Kent, Ross, 6" x 14" Three Roll Mills.
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- 3—Robinson Gyrotary Sifters, 30" x 104", Triple Deck.
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## 2—OLIVER PRECOAT PRESS. FILTERS 5'3" x 3'-TYPE 316 S.S.

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## DRYERS

Proctor & Schwartz Apron Dryers; 8' wide S.S. Apron 5 Sections; 34 1/2' overall; complete accessories. Buffalo Double Drum Lab. Dryer with Stainless Rolls 5" x 7" in vacuum housing. Stokes Rotary Jktd. Dryers; 18" x 8" and 34" x 10" ASME Jktd. and Agitated. Rotary Jacketed Steel Dryer, 18" x 8". Louisville Rotary Kiln; 41" x 15". Louisville Stainless Steel Rotary Dryer; 30" x 28" completely equipped. Squier Rotary Atmospheric Dryer with Stainless Hexagon Shell, 30" x 20". Hersey Rotary Gas Fired Dryer 5' x 26' counter current type with accessories. Stainless Lined Rotary Dryer; 50" x 20' with Burner, Combustion Chamber, etc. Bagley Sewell Double Drum Dryer 28" x 60" with all accessories. Buffalo Double Drum Dryer 40" x 120". Carrier Silica-Gel Dehumidifier #BRG. Ft. Wayne Sterilizer 61" x 124" with agitator and 5 HP motor. American Sterilizer 30" x 48" x 54". 2 Monel Lab. Sterilizers; 16" x 24" (1) electrically heated (1) by gas.

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Pfaudler Glass Lined Reactors up to 1000 gal. capacity; some jktd. Agtd. 2 Stainless 1000 Gal. Vert. Jktd. Vacuum Reactors Pancake coils; agitated. Special Lot of Still Pots, 30 gal. to 500 gal. in Stainless, Steel, Monel, Nickel; with Columns. Pfaudler 300 Gal. Series E Glass Lined Reactors. Rotating Jacketed Aluminum Vacuum Fermenter; 3' x 8'. 1500 gal. Steel Jacketed and Agitated Heavy Duty Pressure Vessel. A. O. Smith Stainless Lined 11,000 gal. Pressure Tanks; 10x187"; 135 PSI. ASME Aluminum Reactor 3050 gal. Manhole Types; 8" x 12"; dished heads. Lancaster Stainless Lined Rotary Reactor, 50" x 17 1/4"; 350 PSI; Jacketed.

## CENTRIFUGALS

Fletcher Standard Centrifuge 12" in Stainless Steel. A.T.&M. 26" Stainless Suspended Type Centrifuge. A.T.&M. Rubber Cov. 30" Susp. Centrifugal; Ann Diesel. Tolhurst 36" S/S Suspended; with Pump and Bottom Dump. A.T.&M. 60" S/S Suspended center slung; vapor tight. Sharples 5/S Super-D-Canter; 10 HP. Sharples H2 Nozzlejector; 1000 GPH. Sharples C20 Super-D-Hydrator in 316 Stainless; 20 HP. Bird Solid Bowl Continuous Centrifuge; 32" x 50"; 316 S/S. Bird Stainless Steel Conical Cont. Centrifugal; 24" x 38".

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### EVAPORATORS—VACUUM PANS

- 1—Buflovak evap., 588 sq. ft. double effect, vert. long tube, T304 SS.
- 2—Nickel clad evaporators, 400 & 250 sq. ft. vert. long tube
- 1—Stokes evaporator, 236 sq. ft. double effect, T316 SS
- 2—Buflovak evaporators, 250, 20 sq. ft., forced circulation, T304 SS, 1953
- 1—Struthers-Wells evaporator, 625 sq. ft., T347 SS, full vacuum
- 3—Sanitary Vacuum Pans, 6' dia. SS, internal coils

### PRESSURE LEAF FILTERS

- 1—Niagara, T316 SS, 510 sq. ft.
- 1—Niagara #80-30, T304 SS, 80 sq. ft.
- 1—Niagara #36H-110, T304 SS, 100 sq. ft., 1954, ASME
- 2—Sweetland filters: #12, 7
- 2—Sperry 30" filter presses, ni-resist

### TABLET PRESSES

- 1—Stokes #R, single punch, UNUSED
- 2—Stokes #T, single punch
- 2—Stokes #DDS-2 rotary
- 1—Stokes #RD-4 rotary
- 2—Kux #25 rotary

### CENTRIFUGALS, CONTINUOUS

- 1—Bird 18" x 28", T304 SS, conical
- 1—Bird 18" x 28", steel, solid bowl
- 4—Bird 24" x 24", monel, type CH
- 1—Bird 24" x 36", monel, horiz. bowl
- 1—Bird 32" x 50", T316 SS, horiz.
- 1—Bird 40" x 60", T304 SS, horiz. bowl
- 1—Sharples Model G-2, tinned steel
- 5—Sharples C-20 Super-D-Hydrators T316 SS
- 1—Sharples C-27 Super-D-Hydrator, monel
- 2—Sharples #PN-14 Super-D-Canters, T316 SS
- 1—Sharples #AS-16, T304 SS, Separator bowl, 1953
- 6—Sharples #16, T304 SS, Clarifier
- 2—Sharples #18V, steel vapor tight
- 2—DeLaval #BUH-3930, SS, clarifier

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- 4—3500 gal. Nickel-clad tanks, 6'6" x 12', Vacuum
- 2—Oliver 5'3" x 3' rotary vacuum filters, T316 SS, ASME 25#
- 1—7'6" x 100' rotary kiln, (3) tire, 1/2" shell
- 1—Allis-Chalmers 7' x 50' rotary dryer, 1/2" Dbl. Shell
- 10—U-tube heat exchangers, T304 SS, 185 sq. ft.

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- 4—A-C 7' x 24' compreb., 450 HP
- 4—A-C 5' x 22' ball-tube, 150 HP
- 1—A-C 6' x 15' ball, 150 HP
- 1—A-C 6' x 16' ball, 30 HP
- 1—Kennedy 4' x 8' rod, epd., 50 HP
- 1—Denver 4' x 10', rod, 60 HP
- 1—Hardinge 4'6" x 16' conical, 25 HP
- 1—Hardinge 6' x 36" conical, 75 HP

### DOUBLE DRUM DRYERS

- 3—Buflovak 42" x 120", 125# drums
- 1—American 42" x 120", atm.
- 1—Buflovak 42" x 90", atm.
- 2—American 36" x 84", Vacuum
- 1—Buflovak 32" x 72", atm.
- 1—Buflovak 32" x 52", atm.
- 1—Witteman 22" x 38", atm.

### ROTARY KILNS

- 1—11' x 155' Taylor, 7/8" shell
- 1—8' x 126' Vulcan, 3/4" shell
- 1—8' x 115', 5/8" shell, 2-tire
- 2—7'6" x 100', 1/2" shell, 3-tire
- 1—4' x 24', 2-tire

### CENTRIFUGALS, BASKET

- 1—A.T.&M. 48" Susp., T304 SS perf. basket, vapor tight, 30 HP
- 1—Bird 40" Susp., steel imperi. basket
- 1—Fletcher 40" susp., steel perf. basket
- 1—Fletcher 30" susp., T304 SS, Perf.
- 1—Fletcher 30" underdriven T304 SS perf. basket
- 1—Tolhurst 26" underdr., T316 SS, XP
- 1—Fletcher 12" underdriven, T304 SS

### DISTILLATION COLUMNS

- 5—Copper Bubble cap columns: 24" dia. x 11 plate; (2) 42" dia. x 20 plate; 42" dia. x 40 plate
- 4—Copper Tunnel cap Columns: 24" dia. x 30 plate; 36" dia. x 27 plate; 36" dia. x 39 plate

MILLS—BALL—5' x 36" Hardinge Conical w/elec. ear, Syntron Feeder, Loop Classifier, etc., 6' x 36" Hardinge (unused) 8" x 36"—8' x 48"—10" x 48" w/16" Sturtevant Classifier.

MILLS—HAMMER—25 Hp Wms.—30 HP Mikre 3W—50, 100 HP Wms.—125 HP Jeffrey 36"—50"—42"—400 HP Penna. 24 x 72" (SXT 14)

MILLS—PEBBLE—36" x 42"—36" x 48"—5' x 6"—6' x 5' porc. lined 41/2" x 16" Hard. Conical, Buhrlstone

AUTOCLAVES—40 Gal. 5/5—100 Gal.—150 Gal. Jacketed/agitated.

SCREENS—3 x 5 (single/double)—3' x 10' double—4 x 10 single Tyler Hammer—20" x 81"—40" x 84" Rotex (single/double)—42" x 10' Cedar Rapids (double)—5' x 12' double Robin

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2—Struthers Wells type 316 SS 3500 gal. jacketed reactors with coils and agitators  
1—5700 gal. SS horizontal storage tank  
4—2500 gal. SS vertical tanks  
1—Link Belt steel roto louvre dryer, Model 1003-30, complete with all auxiliary equipment. Year built 1954.

**AUTOCLAVES, KETTLES AND REACTORS**

1—Blaw-Knox 400 gal. steel jacketed autoclave, 570# internal pressure, 85# jacket  
1—100 gal. type 316 SS jacketed reactor, 150# internal pressure, 75# jacket with impeller type agitator  
1—Tippett & Wood 2500 gal. jacketed steel kettle  
1—Columbia Engineering high pressure storage tanks, 2400 gal., 265# working pressure  
1—Dover Tank Co. horizontal 4000 gal. nickel tank, 30 psi.

**DRYERS**

1—Proctor & Schwartz 2 truck dryer with stainless steel trays  
4—Link Belt steel roto louvre dryers, Model 207-10, 310-20, 310-16, 604-20  
1—Bulovak double drum dryer 42" x 120"  
1—Stokes Model 59DS steel rotary vacuum dryer, 5' x 30'  
1—Stokes double drum dryer, 5' x 12'  
1—Louisville rotary steam tube dryer, 8' x 45'  
1—Louisville SS rotary kiln, 30" x 28', complete  
1—Stokes SS rotary vacuum dryer, 2' x 6'  
6—Stokes steel jacketed rotary vacuum dryers, 3' x 15'  
1—Louisville SS rotary dryer, 8' x 50'  
1—Louisville rotary dryer, 38" x 40' type L

**FILTERS**

1—Oliver horizontal filter, 6'6"  
1—Sweetland #3 SS filter  
1—Niagara SS filter Model 510-28  
1—Oliver horizontal filter, 3'  
1—Feinc SS rotary vacuum string filter, 3' x 3' (NEW)  
10—Shriver plate and frame filter presses, 12" to 42"  
12—Sweetland #12 Filters with 72 SS leaves  
1—Shriver rubber lined filter press, 36" x 36"

**MIXERS**

1—Patterson jacketed vacuum SS kneader master, sigma blades, 300 gal. working capacity  
3—Robinson type 316 SS sigma type jacketed heavy duty mixers, 300 gal. 60 HP.  
5—Baker Perkins double arm sigma blade mixers, 100 gal.  
3—Howes 40 cu. ft. rubber covered ribbon blenders  
1—Leader SS jacketed 51 cu. ft. ribbon blander



**THE GELB GIRL—APRIL 1959**

**MISCELLANEOUS**

2—Heat Transfer Products steel bubble cap columns, 36" and 42" with 5 and 10 trays  
1—Acme steel bubble cap column 42" dia. with 10 trays  
2—Patterson Kelley steel heat exchangers, 1000 sq. ft. each  
6—Struthers Wells heat exchangers, 885 sq. ft.  
1—Patterson Kelley steel heat exchanger, 427 sq. ft.  
50—Steel heat exchangers from 15 sq. ft. to 400 sq. ft.  
30—Struthers Wells SS heat exchangers, 650 sq. ft. each  
1—Struthers Wells type 316 SS heat exchanger, 330 sq. ft.  
10—Davis Engineering type 316 SS heat exchangers, 170 sq. ft. (NEW)  
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## INDEX OF

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Abbé Engineering Co. . . . .	197
Aldrich Pump Co. . . . .	110
Allegheny Ludlum Steel Corp. . . .	60
Allied Chemical Corp. . . . .	
General Chemical Div. . . . .	73
Solvay Process Div. . . . .	95
Allis-Chalmers Mfg. Co. . . . .	
General Machinery Div. . . . .	205
207, 209, 211	
Allis-Chalmers Mfg. Co. . . . .	
Hydraulic Div. . . . .	199
American Air Filter Co. . . . .	38
American Brass Co. . . . .	65
American Hard Rubber Co. . . . .	180, 181
American Machine and Metals, Inc. . . . .	20-21
American Meter Co. . . . .	
Pump Div. . . . .	196
Appleton Electric Co. . . . .	68
Armstrong Machine Works . . . . .	63
Aurora Pump Division . . . . .	
New York Air Brake Co. . . . .	219
Bailey Meter Co. . . . .	112
Baker Perkins, Inc. . . . .	43
Barber-Colman Co. . . . .	58
Becco Chemical Div. . . . .	
Food Machinery & Chemical Corp. . . . .	47
Beckman Instruments, Inc. . . . .	87
Bethlehem Steel Co. . . . .	42
Bird Machine Co. . . . .	2
Blaw-Knox Co. . . . .	
Power Piping Div. . . . .	106

**Advertising Sales  
Representatives**

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San Francisco 4 . . . . .	W. C. Woolston
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St. Louis 8 . . . . .	J. M. Rodger, Jr.
3617 Olive St. . . . .	JEfferson 5-4867

## ADVERTISERS

Boardman Co. ....	178
Bridgeport Brass Co. ....	56
Brookfield Engrg. Laboratories. ....	217
Buell Engineering Co. ....	175
Buffalo Meter Co., Inc. ....	191
Buffalo Forge Co. ....	4

Cambridge Instrument Co., Inc. ....	219
Cambridge Wire Cloth Co. ....	40
Carlson Inc., G. O. ....	39
Carrier Conveyor Corp. ....	212
Celanese Corp. of America. ....	26-27
Chemical & Power Products. ....	198
Cherry-Burrell Corp. ....	45
Chicago Bridge & Iron Corp. ....	2nd Cover
Chiyoda Chemical Engrg. & Construction Corp. ....	186
Cleaver Brooks Co. (Special Products) ....	46
Combustion Engineering, Inc. ....	124
Raymond Division. ....	32
Commercial Filters Corp. ....	185
Continental Can Co. ....	232
Continental Gin Co. ....	10-11
Cooper-Bessemer Corp. ....	79
Corning Glass Works. ....	22-23
Crane Co. ....	123
Crane Packing Co. ....	174

Darling Valve & Mfg. Co. ....	195
Damascus Tube Co. ....	109
Davenport Machine & Foundry Co. ....	231
Day Co., The ....	220
DeLaval Separator Co. ....	28-29
DeZurik Corp. ....	44
Devcon Corp. ....	197
Distillation Engineering Co. ....	200
Dodge Mfg. Co. ....	168, 169
Dorr-Oliver, Inc. ....	70-71
du Pont de Nemours & Co., Inc. ....	
E. I. Polychemicals Dept. (Teflon) ....	147
Durametallic Tubing Co. ....	173
Duriron Company, Inc., The. ....	165

Eclipse Fuel Engrg. Co. ....	
Norwalk Valve Co. Div. ....	217
Elliott Company ....	24-25, 194
Emery Co., A. H. ....	49
Enjay Company, Inc. ....	91

Fairbanks, Morse & Co. ....	216
Fansteel Metallurgical Corp. ....	218
Fisher Governor Co. ....	18-19
Flowline Corp. ....	6
Fluidizer Company, Div. of Superior Separator Co. ....	122
Foster Wheeler Corp. ....	75
Foxboro Co. ....	51
Fuller Co., The ....	34

Garlock Packing Co. ....	208
General American Transportation Corp., Louisville Dryer Div. ....	115
Goodrich Industrial Products Co., B. F. (Keroseal) ....	1
Goulds Pumps Inc. ....	113
GPE Controls, Inc. ....	103
Graham Mfg. Co. ....	177
Gustin-Bacon Mfg. Co. ....	186, 187

Harbison-Walker Refractories Co. ....	16-17
Haynes Stellite Co., Div. of Union Carbide Corp. ....	163

## Towers ...

## Tanks

## Pumps

## Compressors

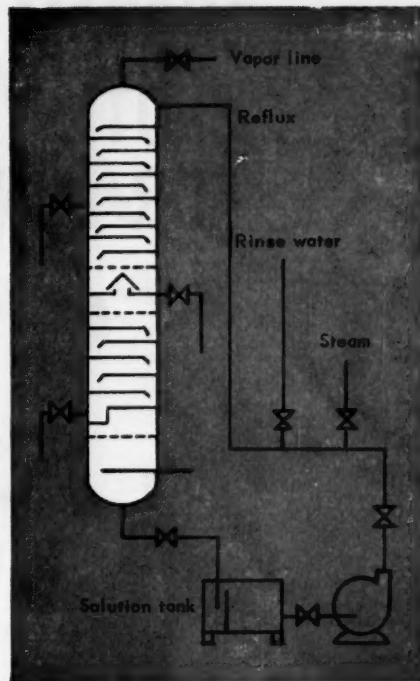
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## ADVERTISERS . . .

Hercules Powder Co.	66
Heyl & Patterson, Inc.	85
Hocker Chemical Corp.	234
Hough Co., Frank G.	50

International Nickel Co.	52
--------------------------	----

James Gear Mfg. Co., D. O.	215
Jeffrey Mfg. Co.	36
Jenkins Bros.	117
Jones & Laughlin Steel Corp.	101
Joy Mfg. Co.	7

Kennedy Van Saun Mfg. & Engrg. Co.	213
Kidde & Co., Walter	173
Knox Porcelain Corp.	217
Komline-Sanderson Engrg. Co.	99

LaLabour Co.	155
Lapp Insulator Corp.	
Process Equip. Div.	61
Link-Belt Co.	83
Liquidometer Corp.	215
Lunkenheimer Co.	37
Luzerne Rubber Co.	233

Mack Iron Works	219
Magnetroil, Inc.	233
Mallinckrodt Chemical Works	176
	231

Manning, Maxwell & Moore, Inc.	35
--------------------------------	----

Mason Neilan, Div. of Worthington Corp.	30-31
---	-------

McGraw-Hill Book Co.	193
----------------------	-----

Metal Hydrides, Inc.	97
----------------------	----

Miller Engineering Corp.	199
--------------------------	-----

Minnesota Mining & Mfg. Co.	192
-----------------------------	-----

	193
--	-----

Mueller Brass Co.	204
-------------------	-----

Nagle Pumps, Inc.	215
-------------------	-----

Nash Engineering Co.	48
----------------------	----

National Drying Machinery Co.	89
-------------------------------	----

National Filter Media Corp.	230
-----------------------------	-----

Newark Wire Cloth Co.	188
-----------------------	-----

New England Tank & Tower Co.	81
------------------------------	----

New York Air Brake Co.	219
------------------------	-----

Norton Company	41
----------------	----

Oakite Products, Inc.	229
-----------------------	-----

Olin Mathieson Chemical Corp.	228
-------------------------------	-----

Pangborn Corp.	179
----------------	-----

Pennsylvania Flexible Metallic Tubing Co.	175
---	-----

Pfaudler Co., Div. of Pfaudler Permutit, Inc.	4th Cover
---	-----------

Phelps Dodge Copper Products Corp.	8-9
------------------------------------	-----

Pitt-Consol Chemical Co.	183
--------------------------	-----

Pittsburgh Lectrodryer Div.	
-----------------------------	--

McGraw-Edison Co.	210
-------------------	-----

Polymer Corporation of Penna.	151
-------------------------------	-----

Porter Company, Inc.	H. K.
----------------------	-------

Forge & Fittings Division	184
---------------------------	-----

Powell Valves, Wm. Powell Co.	153
-------------------------------	-----

Pritchard & Co. of California,	
--------------------------------	--

J. F.	231
-------	-----

Raybestos-Manhattan, Inc.	
---------------------------	--

Packings Div.	214
---------------	-----

Plastic Products Div.	190
-----------------------	-----

Reliance Electric & Engrg. Corp.	3rd Cover
----------------------------------	-----------

Resistoflex Corp.	149
-------------------	-----

Rolock, Inc.	213
--------------	-----

Roots-Connersville Blower, Div.	
---------------------------------	--

of Dresser Industries	53
-----------------------	----

Ryerson & Sons, Inc., Joseph T.	126
---------------------------------	-----



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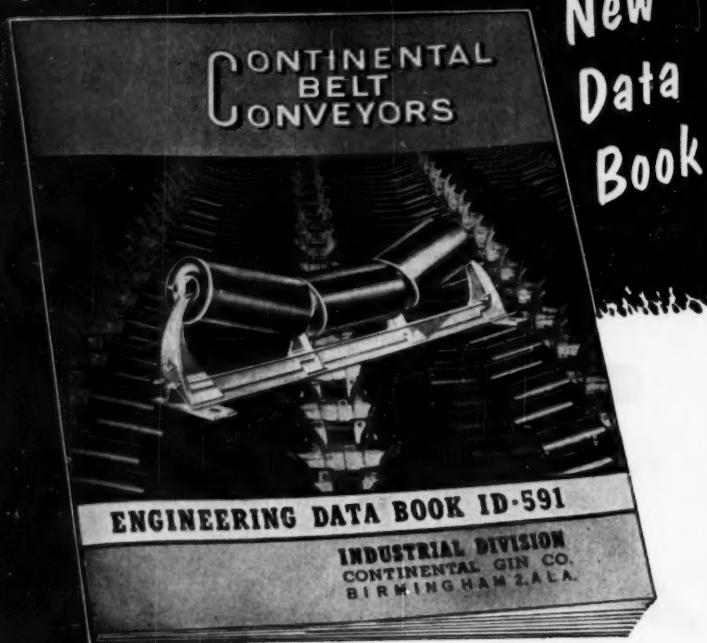
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## ADVERTISERS . . .

Sarco Co.	116
Shamban & Co., W. S.	172
Skinner Co., M. B.	159
Sly Mfg. Co., W. W.	206
Southwestern Supply & Machine Wks.	233
Standard Tube Co.	182
Stokes Corp., F. J.	189, 221
Stone & Webster Engrg Corp.	33
Strahman Valves, Inc.	176
Strong-Scott Mfg. Co.	105
Struthers Wells Corp.	161
Sturtevant Mill Co.	178

Taylor Co., W. A.	171
Taylor Instrument Companies	14-15
Thayer Scale Corp.	182
Thermo Electric Co.	171
Tranter Mfg. Co., Platecoll Div.	62
Traylor Engineering & Mfg. Co.	54

United States Gauge, Div. of American Machine and Metals, Inc.	114
U. S. Industrial Chemicals Co., Div. of National Distillers & Chemicals Corp.	125
U. S. Rubber Co.	167
U. S. Stoneware Co.	12-13

Viking Pump Co.	213
Vogt Machine Co., Henry	145

Wagner Electric Corp.	64
Waukesha Foundry Co.	157
Welding Fittings Corp. (Flowline Corp.)	6
Williams & Co., C. K.	170
Williams Patent Crusher & Pulverizer Co.	59
WKM Division of ACF Industries, Inc.	57
Wyandotte Chemicals Corp. Michigan Alkali Div.	107-108

Yale & Towne Mfg. Co.	93
Yarnall-Waring Co.	55

Professional Services	221
CLASSIFIED ADVERTISEMENTS F. J. Eberle, Business Mgr.	

EMPLOYMENT OPPORTUNITIES	222, 223
-----------------------------	----------

EQUIPMENT (Used or Surplus New) For Sale	222, 227
--	----------

WANTED Equipment	223
ADVERTISERS INDEX	

Aaron Equipment Company	223
American Air Compressor Corp.	224
Brill Equipment Company	223-224
Equipment Clearing House Inc.	225
First Machinery Corporation	225
Gelb & Sons, R.	227
Heat & Power Company, Inc.	222-224
Land Inc., L. J.	225
Lawler Company	226
Loeb Equipment Supply Company	226
Machinercraft Corporation	224
Machinery & Equipment Co., Calif.	222-223-224-225-226
Machinery & Equipment Corp.	
N. J.	225
Mat Supply Company	226
McKee & Company, Arthur G.	223
Milwaukee Gas Light Company	224
Perry Equipment Corporation	224-226
Process Equipment Sales Corp.	225
Stein Equipment Company	224
Union Standard Equipment Co.	225

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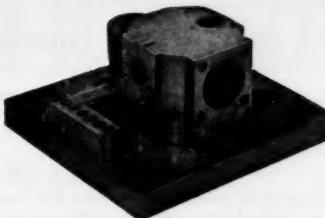
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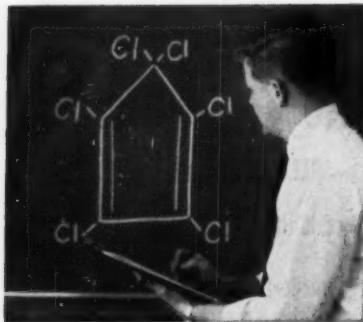
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<input type="checkbox"/> Phosphorus, white	<input type="checkbox"/> Phosphorus Sesquisulfide

*Clip and mail to us with your name, title, company address. (When requesting samples, please use business letterhead.)*

### HOOKER CHEMICAL CORPORATION

404 FORTY-SEVENTH STREET, NIAGARA FALLS, N. Y.

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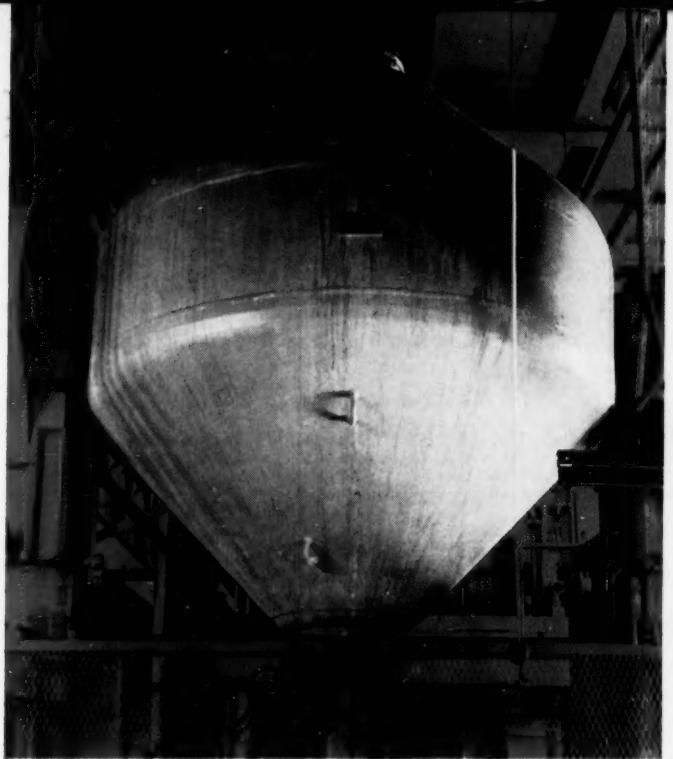
D-1072

# FLUIDICS

is a

Pfaudler Permutit program providing  
the know-how  
the equipment  
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for solving problems involving fluids

Here is an example of FLUIDICS at work  
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For more information, write to our Pfaudler Division, Dept. CEB-49, Rochester 3, New York, for Bulletin No. 963.

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